[Notice 314]

MOTOR CARRIER BOARD TRANSFER PROCEEDINGS

Synopses of orders entered by the Motor Carrier Board of the Commission pursuant to sections 212(b), 206(a), 211, 312(b), and 410(g) of the Interstate Commerce Act, and rules and regulations prescribed thereunder (49 CFR Part 1132), appear below:

Each application (except as otherwise specifically noted) filed after March 27, 1972, contains a statement by applicants that there will be no significant effect on the quality of the human environment resulting from approval of the application. As provided in the Commission's Special Rules of Practice any interested person may file a petition seeking reconsideration of the following numbered proceeding on or before August 6, 1973. Pursuant to section 17(8) of the Interstate Commerce Act, the filing of such a petition will postpone the effective date of the order in that proceeding pending its disposition. The matters relied upon by petitioners must be specified in their petitions with particularity.

Finance Docket No. 27297. By order entered July 5, 1973, the Motor Carrier Board approved the transfer to C-Line Forwarding Co., Inc., Warwick, Rhode Island, of that portion of Fourth Amended Permit and Order No. FF-96, issued September 6, 1972, to New England Forwarding Company, Inc., North Bergen, N.J., authorizing operations, in interstate commerce, as a freight forwarder of commodities generally, between New York, N.Y., points in Nassau, Westchester, and Rockland Counties, N.Y., and Passaic, Essex, Union, Hudson, Middlesex, and Bergen Counties, N.J., on the one hand, and, points in Philadelphia, Delaware, and Montgomery Counties, Pa., Camden and Gloucester Counties, N.J., Baltimore, Md., points in Baltimore, Anne Arundel, Prince George's, Montgomery, and Howard Counties, Md., Alexandria, Va., Arlington and Fairfax Counties, Va., and the District of Columbia, on the other; and between points in the areas above described, on the one hand, and, points in Rhode Island, and Bristol, Suffolk, Middlesex, Norfolk, Plymouth, Essex, and Worcester Counties, Mass., on the other, restricted against the transportation of traffic having a prior or subsequent movement in foreign commerce. Ronald N. Cobert, 1730 M St., N.W., Washington, D.C. 20036 and William J. Lippman, 1819 H St., N.W., Washington, D.C., attorneys for transferee and transferor, respectively.

No. MC-FC-74512. By order of July 5, 1973, Motor Carrier Board approved the transfer to H. and H. Hauling, Inc., 469 Main St., Brookville, Pa., 15825, of the operating rights in Certificate No. MC-128047 (Sub-No. 1), issued December 4, 1970, to Clark R. Ingram, R.D. #1, Weedville, Pa., 15868, authorizing the transportation of coal, from points in Huston Township (Clearfield County), Pa., and points in Elk County, Pa., to points in Erie, Chautauqua, and Niagara Counties, N.Y. Arthur J. Diskin, 806 Frick Building, Pittsburgh, Pa. 15219 attorney for applicants.

No. MC-FC-74521. By order of July 11, 1973, the Motor Carrier Board approved the transfer to OC Transportation Co., Inc., Beverly, N.J., of the operating rights in Permits Nos. MC-114332, MC-114332 (Sub-No. 4), MC-114332 (Sub-No. 5), and MC-114332 (Sub-No. 6) issued January 12, 1968, May 19, 1971, December 23, 1969, and August 30, 1972, respectively, to Rayburn Trucking, Inc., Elizabeth, N.J., authorizing the transportation of (1) such merchandise as is dealt in by wholesale, retail, and chain grocery and food business houses, and in connection therewith, equipment, material, and supplies used in the conduct of such business, between points in a defined area of New Jersey, Delaware, and Pennsylvania; (2) fruits, vegetables, farm products, poultry, and sea food, from points in Delaware, New Jersey, and Pennsylvania, to points in the territory indicated above; (3) groceries and grocery store supplies, from Philadelphia, Pa., to Baltimore, Md., and points in New Jersey; (4) sugar, from Edgewater and Linden, N.J., to points in New York and New Jersey within 40 miles of Edgewater, and sugar and sugar products, in containers, from New York, N.Y., and Linden, N.J., to points in New Jersey (except Linden) and New York within 40 miles of Columbus Circle, New York, N.Y., and (5) wearing apparel and component parts used in the manufacture thereof, between New York, N.Y., and Elizabeth and Middlesex, N.J., on the one hand, and, on the other, Miami, Fla., restricted to the transportation of traffic in foreign commerce having a prior or subsequent movement by water or air, and limited to a transportation service performed under a continuing contract, or contracts, with Trade Wind Fashions, Ltd., of New York, N.Y. Charles J. Williams, 47 Lincoln Park, Newark, N.J. 07102 Attorney for applicants.

No. MC-FC-74522. By order of July 3, 1973, the Motor Carrier Board approved the transfer to Harry Charles Freeman, D/B/A New Basin Homing Pigeon Training, Brooklyn, N.Y. 11234, of Certificate No. MC-114556 issued May 18, 1971, to Walter Dittenheimer, Howard Beach, N.Y. 11414, authorizing the transportation of Homing pigeons, from Brooklyn and Queens Boroughs, N.Y., to Wilmington, Del., Aberdeen, Md., Charlottesville and Danville, Va., Washington, D.C., points in New Jersey, and those in that part of Pennsylvania east of the Susquehanna River. Morris Honig, 150 Broadway, New York, N.Y. 10038, attorney for applicant.

[SEAL] ROBERT L. OSWALD,
Secretary.

[FR Doc.73-14566 Filed 7-16-73;8:45 am]

[Notice 91]

MOTOR CARRIER TEMPORARY AUTHORITY APPLICATIONS

JULY 6, 1973.

The following are notices of filing of application, except as otherwise specifically noted, each applicant states that there will be no significant effect on the quality of the human environment resulting from approval of its application, for temporary authority under section 210a(a) of the Interstate Commerce Act provided for under the new rules of Ex Parte No. MC-67, (49 CFR Part 1131) published in the FEDERAL REGISTER, issue of April 27, 1965, effective July 1, 1965. These rules provide that protests to the granting of an application must be filed with the field official named in the FEDERAL REGISTER publication, within 15 calendar days after the date of notice of the filing of the application is published in the FEDERAL REGISTER. One copy of such protests must be served on the applicant, or its authorized representative, if any, and the protests must certify that such service has been made. The protests must be specific as to the service which such protestant can and will offer, and must consist of a signed original and six (6) copies.

A copy of the application is on file, and can be examined at the Office of the Secretary, Interstate Commerce Commission, Washington, D.C., and also in field office to which protests are to be transmitted.

MOTOR CARRIERS OF PROPERTY

No. MC 26396 (Sub-No. 80 TA) filed June 25, 1973 Applicant: POPELKA TRUCKING CO. doing business as THE WAGGONERS P.O. Box 990 201 W. Park Livingston, Mont. 59047 Applicant's representative: Wayne Waggoner (same address as above) Authority sought to operate as a *common carrier*, by motor vehicle, over irregular routes, transporting: (1) *Meat scraps, blood meal, bone meal*, in bulk and bags; and (2) *Bentonite*, in bulk and bags: (1) from the plant sites of Billings, Rendering, Midland Empire Packing Company, Pierce Packing, and Montana Beef Industries, at or near Billings, Mont.; Great Falls Meat Company, at or near Great Falls, Mont.; Western Montana By-Products, at or near Missoula, Mont.; and Miles City Rendering Company, at or near Miles City, Mont., to points in Minnesota, Iowa, South Dakota, North Dakota, Washington, and Oregon; (2) from the plant sites of American Colloid at or near Belle Fourche, S. Dak., to points in Minnesota, Iowa, South Dakota, North Dakota, Nebraska, Wisconsin and Illinois, for 180 days. SUPPORTING SHIPPER: Wellens & Co., Inc., 6700 France Avenue South, Minneapolis, Minn. 55435. SEND PROTESTS TO: Paul J. Labane, District Supervisor, Bureau of Operations, Interstate Commerce Commission, Rm. 222 U.S. Post Office Bldg., Billings, Mont. 59101.

No. MC 52921 (Sub-No. 23 TA) filed June 26, 1973 Applicant: RED BALL, INC. 317 E. Lee (Collins Bldg.) P. O. Box 520 Sapulpa, Okla. 74066 Applicant's representative: Lewis C. Johnson 200 Law Bldg. 500 W. 7th Tulsa, Okla. 74119 Authority sought to operate as a *common carrier*, by motor vehicle, over irregular routes, transporting: *Paper and paper products*, from the plant site and storage facilities of Olinkraft, Inc., Monroe and West Monroe, La., to points in

Arkansas, Colorado, New Mexico, Oklahoma, Missouri and Texas, for 180 days. SUPPORTING SHIPPER: H. T. Nichols, Traffic Manager, Olinkraft, Inc., P. O. Box 488, West Monroe, La. 71291. SEND PROTESTS TO: C. L. Phillips, District Supervisor, Bureau of Operations, Interstate Commerce Commission, Rm. 240-Old P. O. Bldg., Ft. Worth, Tex. 73102.

No. MC 100666 (Sub-No. 248 TA) filed May 31, 1973 Applicant: MELTON TRUCK LINES, INC. 1129 Grimmett Drive P. O. Box 7666 Shreveport, La. 71107 Authority sought to operate as a *common carrier*, by motor vehicle, over irregular routes, transporting: *Plastic pipe*, from Rolla, Mo., to points in Arkansas, Illinois, Iowa, Kansas, Louisiana, Mississippi, Nebraska, Oklahoma, and Texas, for 180 days. SUPPORTING SHIPPER: Some Industries, Inc., Pipe Div., Box 1235, Rolla, Mo. 65401, Mr. John L. Ellis, Customer Service Mgr. SEND PROTESTS TO: Paul D. Collins, District Supervisor, Interstate Commerce Commission, Bureau of Operations, T-9038 U.S. Postal Service Building, 701 Loyola Avenue, New Orleans, La. 70113.

No. MC 107295 (Sub-No. 649 TA) filed June 22, 1973 Applicant: PRE-FAB TRANSIT CO 100 South Main Street P.O. Box 146 Farmer City, Ill. 61842 Applicant's representative: Bruce J. Kinnee (same address as above) Authority sought to operate as a *common carrier*, by motor vehicle, over irregular routes, transporting: *Cabinets, wooden, parts thereof and counter tops*, with or without vinyl covering or plastic, set up or knocked down, from the Boise Cascade Corporation facilities at Fendwick, Paw Paw and Moorefield, W. Va., and Berryville, Orange and Winchester, Va., to all points in the continental United States, for 180 days. SUPPORTING SHIPPER: Charles G. Wise, Mgr., Transportation Commerce, Boise Cascade Corporation, P.O. Box 7747, Boise, Idaho 83707. SEND PROTESTS TO: Harold C. Jolliff, District Supervisor, Bureau of Operations, Interstate Commerce Commission, Leland Office Building, 527 East Capitol Avenue, Room 414, Springfield, Ill. 62701.

No. MC 107496 (Sub-No. 900 TA) filed June 26, 1973 Applicant: RUAN TRANSPORT CORPORATION P.O. Box 855 (Box zip 50304) Keosauqua Way at Third St. Des Moines, Iowa 50309 Applicant's representative: E. Check (same address as above) Authority sought to operate as a *common carrier*, by motor vehicle, over irregular routes, transporting: *LPG*, in bulk, in tank vehicles, from Watertown, Wis., to points in Iowa, Illinois, and Minnesota, for 150 days. SUPPORTING SHIPPER: Hydrocarbon, Inc., 765 North Church Street, Watertown, Wis. 53094. SEND PROTESTS TO: Herbert W. Allen, Transportation Specialist, Bureau of Operations, Interstate Commerce Commission, 875 Federal Building, Des Moines, Iowa 50309.

No. MC 114552 (Sub-No. 85 TA) filed June 25, 1973. Applicant: SENN TRUCKING COMPANY, P.O. Box 333, Newberry, S.C. 29108. Applicant's representative: Terry P. Wilson, 919 Eighteenth Street NW., Washington, D.C. 20006. Authority sought to operate as a *common carrier*, by motor vehicle, over irregular routes, transporting: *Urethane and urethane products*, from the facilities of the Celotex Corporation at or near Elizabethtown, Ky., to points in Virginia, North Carolina, South Carolina, Georgia and Florida, for 180 days. SUPPORTING SHIPPER: The Celotex Corporation, Tampa, Fla. 33607. SEND PROTESTS TO: District Supervisor E. E. Strotheid, Bureau of Operations, Interstate Commerce Commission, 300 Columbia Building, 1200 Main Street, Columbia, S.C. 29201.

No. MC 114606 (Sub-No. 6 TA) filed June 26, 1973. Applicant: S. F. DOUGLAS TRUCK LINE, INC., 587 First Street SW., P.O. Box 2766, New Brighton, Minn. 55112. Applicant's representative: F. H. Kroeger, 2288 University Avenue, St. Paul, Minn. 55114. Authority sought to operate as a *common carrier*, by motor vehicle, over irregular routes, transporting: *Sugar*, other than liquid, in bulk, in tank vehicles, from Chaska, Minn., to Fremont, Nebr., for 180 days. SUPPORTING SHIPPER: American Crystal Sugar Company, P.O. Box 419, Denver, Colo. 80201. SEND PROTESTS TO: District Supervisor Raymond T. Jones, Bureau of Operations, Interstate Commerce Commission, 448 Federal Bldg., 110 S. 4th Street, Minneapolis, Minn. 55401.

No. MC 114896 (Sub-No. 7 TA) filed June 26, 1973 Applicant: PUROLATOR SECURITY, INC. Suite 1001 1341 W. Mockingbird Lane Dallas, Tex. 75202 Applicant's representative: William E. Fullingim (same address as above) Authority sought to operate as a *contract carrier*, by motor vehicle, over irregular routes, transporting: *Food coupons*, between all points in the United States (except Alaska and Hawaii), for 180 days. SUPPORTING SHIPPER: General Services Administration, Chief, Contracts and Negotiations Branch, Washington, D.C. 20406. SEND PROTESTS TO: Transportation Specialist Gerald T. Holland, Interstate Commerce Commission, Bureau of Operations, 1100 Commerce Street, Room 13C12, Dallas, Tex. 75202.

No. MC 116474 (Sub-No. 27 TA) filed June 26, 1973 Applicant: LEAVITTS FREIGHT SERVICE, INC. 3855 Marcola Road Springfield, Oreg. 97477 Applicant's representative: David C. White 2400 S.W. Fourth Avenue Portland, Oreg. 97201 Authority sought to operate as a *contract carrier*, by motor vehicle, over irregular routes, transporting: *Laminated wood products*, for the account of Rosboro Lumber Company, from Springfield, Oreg., to points in Arizona, for 180 days. SUPPORTING SHIPPER: Rosboro Lumber Company, P.O. Box 1098, Springfield, Oreg. 97477. SEND PROTESTS TO: District Supervisor A. E. Odoms, Bureau of Operations, Interstate Commerce Commission, 450 Multnomah Bldg., 319 S.W. Pine Street, Portland, Oreg. 97204.

No. MC 119789 (Sub-No. 164 TA) filed June 27, 1973 Applicant: CARAVAN REFRIGERATED CARGO, INC. P.O. Box 6188 1612 East Irving Blvd. Dallas, Tex. 75222 Applicant's representative: James K. Newbold, Jr. (same address as above) Authority sought to operate as a *common carrier*, by motor vehicle, over irregular routes, transporting: *Meats, meat products, and meat by-products, and articles distributed by meat packinghouses*, as described in Sections A and C of Appendix I to the report in *Descriptions in Motor Carrier Certificates* 61 M.C.C. 209 and 766 (except hides and commodities in bulk), from Liberal, Kans., to points in Michigan and Ohio, for 180 days. RESTRICTION: Restricted to the transportation of traffic originating at the plant site and storage facilities of National Beef Packing Company, Inc., and destined to the named destinations. SUPPORTING SHIPPER: National Beef Packing Company, P.O. Box Q, Liberal, Kans. 67901. SEND PROTESTS TO: Gerald T. Holland, Transportation Specialist, Interstate Commerce Commission, Bureau of Operations, 1100 Commerce Street, Room 13C12, Dallas, Tex. 75202.

No. MC 123048 (Sub-No. 262 TA) filed June 26, 1973 Applicant: DIAMOND TRANSPORTATION SYSTEM, INC. 1919 Hamilton Avenue P.O. Box A Racine, Wis. 53401 Applicant's representative: Carl S. Pope (same address as applicant) Authority sought to operate as a *common carrier*, by motor vehicle, over irregular routes, transporting: *Agricultural tractors and parts therefor* when transported in same vehicle at the same time, from Milwaukee, Wis., to points in Illinois and Iowa, for 180 days. SUPPORTING SHIPPER: Deere & Company, Transportation Department, 400 19th Street, Moline, Ill. 61265, (S. H. Lane, Supervisor, Truck Transportation). SEND PROTESTS TO: District Supervisor John E. Ryden, Interstate Commerce Commission, Bureau of Operations, 135 West Wells Street—Room 807, Milwaukee, Wis. 53203.

No. MC 125785 (Sub-No. 21 TA) filed June 25, 1973 Applicant: SATURN EXPRESS, INC. 8716 L Street Omaha, Nebr. 68127 Applicant's representative: Donald L. Stern 530 Univac Building Omaha, Nebr. 68106 Authority sought to operate as a *contract carrier*, by motor vehicle, over irregular routes, transporting: *Edible corn products and pretzels*, from Terre Haute, Ind., to Omaha, Nebr., for 180 days. SUPPORTING SHIPPER: Kitty Clover Division, Fairmont Foods Co., 24th & Martha Streets, Omaha, Nebr. SEND PROTESTS TO: District Supervisor Carroll Russell, Bureau of Operations, Interstate Commerce Commission, 711 Federal Office Building, Omaha, Nebr. 68102.

No. MC 128343 (Sub-No. 25 TA) filed June 25, 1973 Applicant: C-LINE, INC. Tourtellot Hill Road Chepachet, R.I.

02814 Applicant's representative: Ronald N. Cobert 1730 M Street, N.W. Washington, D.C. 20036 Authority sought to operate as a *common carrier*, by motor vehicle, over irregular routes, transporting: *Cinder blocks*, from Warwick, R.I., to Fitchburg, Harwich, Lexington and Lowell, Mass., for 180 days. SUPPORTING SHIPPER: Cinder Products Corporation, 399 Kilvert Street, Warwick, R.I. 02886. SEND PROTESTS TO: Gerald H. Curry, District Supervisor, Bureau of Operations, Interstate Commerce Commission, 187 Westminster Street, Providence, R.I. 02903.

No. MC 128659 (Sub-No. 3 TA) filed June 27, 1973 Applicant: ORBITAL TRANSPORT, INC. 2647 Karen Street Bellmore, N.Y. 11710 Applicant's representative: Arthur J. Piken One Lefrak City Plaza Flushing, N.Y. 11368 Authority sought to operate as a *contract carrier*, by motor vehicle, over irregular routes, transporting: *Glass Bottles*, from Wharton, North Bergen, Millville and Freehold, N.J. and Orangeburg, N.Y., to Garden City and Patchogue, N.Y. under contract with PepCom Industries, Inc., for 180 days. SUPPORTING SHIPPER: PepCom Industries, Inc., Roosevelt Field, Garden City, N.Y. 11530. SEND PROTESTS TO: Anthony D. Giaimo, District Supervisor, Interstate Commerce Commission, Bureau of Operations, 26 Federal Plaza, New York, N.Y. 10007.

No. MC 134323 (Sub-No. 52 TA) filed June 26, 1973 Applicant: JAY LINES, INC. 720 N. Grand Street P.O. Box 4146 (Box zip 79105) Amarillo, Tex. 79107 Applicant's representative: Gailyn Larson, P.O. Box 80806 Lincoln, Nebr. 68501 Authority sought to operate as a *contract carrier*, by motor vehicle, over irregular routes, transporting: *Meats, meat products, meat by-products and articles distributed by meat packinghouses* as described in Sections A and C of Appendix I to the report in *Descriptions in Motor Carrier Certificates*, 61 MCC 209 and 766, from the facilities of Missouri Beef Packers, Inc. at or near Boise, Idaho, to points in Arizona, California, Colorado, Connecticut, Delaware, Illinois, Indiana, Iowa, Kansas, Maine, Maryland, Massachusetts, Michigan, Missouri, Nebraska, Nevada, New Jersey, New Hampshire, New Mexico, New York, Ohio, Oklahoma, Oregon, Pennsylvania, Rhode Island, Texas, Utah, Vermont, Virginia, Washington, West Virginia, Wisconsin, and the District of Columbia, for 180 days. SUPPORTING SHIPPER: N. L. Cummins, Vice President-Physical Distribution, Missouri Beef Packers, Inc., 630 Amarillo Bldg., Amarillo, Tex. 79101. SEND PROTESTS TO: Haskell E. Ballard, District Supervisor, Interstate Commerce Commission, Bureau of Operations, Box H-4395 Herring Plaza, Amarillo, Tex. 79101.

No. MC 134890 (Sub-No. 3 TA) filed June 18, 1973. Applicant: MARION'S TRANSPORT, INC. 2380 North 124th Street, Wauwatosa, Wis. 53226. Applicant's representative: Carlo Benvenuto (same address as above). Authority sought to operate as a *contract carrier*, by motor vehicle, over irregular routes, transporting: *Cheese and cheese food products*, (1) from Hilbert, Wis. and Weyauwega, Wis., to points in Connecticut, Delaware, District of Columbia, Maryland, Massachusetts, New Jersey, New York, Pennsylvania, Rhode Island, Virginia and West Virginia and (2) from Somerville, Mass., to points in Connecticut, Delaware, District of Columbia, Illinois, Maryland, Michigan, New Jersey, New York, Pennsylvania, Rhode Island, Virginia, West Virginia, and Wisconsin, for the account of Churney Company, Inc., for 180 days. SUPPORTING SHIPPER: Churney Company, Inc., 39 Medford St., Somerville, Mass. 02143 (Paul R. McGee, Vice President). SEND PROTESTS TO: District Supervisor John E. Ryden, Interstate Commerce Commission, Bureau of Operations, 135 West Wells Street Room 807—Milwaukee, Wis. 53203.

No. MC 136713 (Sub-No. 1 TA) filed June 26, 1973. Applicant: AERO LIQUID TRANSIT, INC. 834 West Main Street, Lowell, Mich. 49331. Applicant's representative: Daniel J. Kozera, Jr., 715 McKay Tower, Grand Rapids, Mich. 49502. Authority sought to operate as a *common carrier*, by motor vehicle, over irregular routes, transporting: *Liquefied petroleum gases*, in bulk, in tank vehicles, from points in Kent County, Mich., to points in Indiana, for 180 days. SUPPORTING SHIPPER: Ben Geib, Assistant Manager, A&E Transportation, Inc., 5010 N. Post Road, Indianapolis, Ind. 46226. SEND PROTESTS TO: C. R. Flemming, District Supervisor, Interstate Commerce Commission, Bureau of Operations, 225 Federal Building, Lansing, Mich. 48933.

No. MC 138165 (Sub-No. 1 TA) filed June 25, 1973. Applicant: CANUCK CARRIERS, Ltd., 1514 Meridian Road, N.E., Calgary, Alberta, Canada. Applicant's representative: Joe Gerbase, 404 North 31st Street, Billings, Mont. 59101. Authority sought to operate as a *contract carrier*, by motor vehicle, over irregular routes, transporting: *Farm machinery* and component parts thereof, from Hesston, Kans. and Logan, Utah, to points on the International Boundary Line between the United States and Canada, at or near Pembina and Portal, N. Dak., and Sweetgrass, Mont., for 180 days. SUPPORTING SHIPPER: Hesston Industries, Ltd., 770 9th Avenue S.E., Calgary, Alberta, Canada. SEND PROTESTS TO: Paul J. Labane, District Supervisor, Bureau of Operations, Interstate Commerce Commission, Rm. 222 U.S. Post Office Building, Billings, Mont. 59101.

No. MC 138274 (Sub-No. 2 TA) filed June 25, 1973 Applicant: SHIPPERS BEST EXPRESS, INC. 1656 West 14600 South Riverton, Utah 84065 Applicant's representative: Chester A. Zyblut 1522 K Street, N.W. Washington, D.C. 20005 Authority sought to operate as a *common carrier*, by motor vehicle, over irregular routes, transporting: *Meats, meat products, meat byproducts and articles distributed by meat packing houses* as described in Sections A and C of Appendix I to the report in *Descriptions in Motor Carrier Certificates*, 61 MCC 209 and 766, from the facilities of Missouri Beef Packers, Inc. at or near Boise, Idaho, to points in Washington, California, Oregon, Nevada, Idaho and Utah, for 180 days. SUPPORTING SHIPPER: Missouri Beef Packers, Inc., 630 Amarillo Bldg., Amarillo, Tex. 79101, (N. L. Cummins, Vice President—Physical Distribution). SEND PROTESTS TO: District Supervisor Lyle D. Helfer, Interstate Commerce Commission, Bureau of Operations, 5239 Federal Building, 125 South State Street, Salt Lake City, Utah 84111.

No. MC 138760 TA filed June 27, 1973 Applicant: ABRAMS TRUCKING COMPANY 3011 San Rafael Tampa, Fla. 33609 Applicant's representative: N. W. Abrams (same address as above) Authority sought to operate as a *contract carrier*, by motor vehicle, over irregular routes, transporting: *Dry bulk materials* in dump or side unloading compartmentized vehicles, from or to the plant site locations of Kerr-McGee Chemical Corp. in Alabama, Florida, Georgia, Mississippi, North Carolina and South Carolina, for 180 days. SUPPORTING SHIPPER: Kerr-McGee Chemical Corp., Kerr-McGee Center, Oklahoma City, Okla. SEND PROTESTS TO: District Supervisor Joseph B. Teichert, Interstate Commerce Commission, Bureau of Operations, 5720 S.W. 17th Street, Room 105, Miami, Fla. 33155.

No. MC 138765 (Sub-No. 1 TA) filed June 25, 1973 Applicant: YODER'S MILK TRANSPORT, INC. 8 Salisbury Street Meyersdale, Pa. 15552 Applicant's representative: Harold E. Miller (same address as above). Authority sought to operate as a *contract carrier*, by motor vehicle, over irregular routes, transporting: *Processed milk and dairy products*, from Cumberland, Md., to (1) points in Allegany and Washington Counties, Md.; (2) points in Bedford, Blair, Cambria, Fulton, Huntington, Franklin, and Somerset Counties, Pa.; and (3) points in Monongalia, Preston, Taylor, Barbour, Randolph, Tucker, Hardy, Mineral, Hampshire, Morgan and Berkeley Counties, W. Va., for 180 days. SUPPORTING SHIPPER: Country Belle Cooperative Farmers, 1623 Saw Mill Run Boulevard, Pittsburgh, Pa. 15210. SEND PROTESTS TO: James C. Donaldson, District Supervisor, Bureau of Operations, Interstate Commerce Commission, 2111 Federal Building, Pittsburgh, Pa. 15222.

No. MC 138847 TA filed June 27, 1973 Applicant: AINSWORTH TRUCK LINES, INC. Ainsworth, Iowa 52201 Applicant's representative: Kenneth F. Dudley P.O. Box 279 Ottumwa, Iowa 52501 Authority sought to operate as a *common carrier*, by motor vehicle, over irregular routes, transporting: (1) *Polyester resin panels*, from Williamsburg, Iowa, to points in Arizona, Arkansas, California, Colorado, Illinois, Indiana, Kansas, Michigan, Minnesota, Missouri, Nebraska, Nevada, Oklahoma, Oregon, Texas, Utah, Wisconsin, and Wyoming, and (2) *architectural crushed rock*, from points in the named destination states to Williamsburg, Iowa, for 180 days. SUPPORTING SHIPPER: Poly-Cast Systems, Inc., P.O. Box 660, Williamsburg, Iowa 52361. SEND PROTESTS TO: Herbert W. Allen, Transportation Specialist, Bureau of Operations, Interstate Commerce Commission, 875 Federal Bldg., Des Moines, Iowa 50309.

No. MC 138848 TA filed June 25, 1973 Applicant: MEDICAL DELIVERY SERVICE, INC. 630 West 26th Street New York, N.Y. 10001 Applicant's representative: Robert B. Pepper 168 Woodbridge Avenue Highland Park, N.J. 08904 Authority sought to operate as a *contract carrier*, by motor vehicle, over irregular routes, transporting: *Blood and urine samples, and supplies* for securing samples, and EDP (analysis) reports, in passenger automobiles, between the plantsite of Biochemical Procedures, Hillside, N.J.; New York, N.Y.; points in Nassau and Suffolk Counties, N.Y.; and points in Fairfield, New Haven, and Hartford Counties, Conn., for 180 days. SUPPORTING SHIPPER: Biochemical Procedures, 1350 Liberty Avenue, Hillside, N.J. 07207. SEND PROTESTS TO: Paul W. Assenza, District Supervisor, Bureau of Operations, Interstate Commerce Commission, 26 Federal Plaza, New York, N.Y. 10007.

No. MC 138850 TA filed June 21, 1973 Applicant: OHIO VALLEY TRANSPORT, INC. 762 Marion Road Cincinnati, Ohio 45215 Applicant's representative: Charles H. Schaffner 317 Scott Street Covington, Ky. 41011 Authority sought to operate as a *contract carrier*, by motor vehicle, over irregular routes, transporting: *Paper and paper products*, (1) from Florence, Ky., to all points in Ohio; (2) from Florence, Ky., to Hammond and Gary, Ind.; Chicago, Ill.; and Detroit, Mich.; and (3) from Cincinnati, Ohio, to Florence, Ky., for the account of Equitable Bag Co., Inc., for 180 days. SUPPORTING SHIPPER: Equitable Bag Co., Inc., 7600 Empire Drive, Florence, Ky. 41042. SEND PROTESTS TO: Paul J. Lowry, District Supervisor, Bureau of Operations, Interstate Commerce Commission, 5514-B Federal Building, 550 Main Street, Cincinnati, Ohio 45202.

By the Commission.

[SEAL] ROBERT L. OSWALD, *Secretary*.

[FR Doc.73-14567 Filed 7-16-73;8:45 am]

[Rev. S.O. 994; Rev. I.C.C. Order 79, Amdt. 3]

ST. JOHNSBURY AND LAMOILLE COUNTY RAILROAD

Rerouting or Diversion of Traffic

Upon further consideration of Revised I.C.C. Order No. 79 (St. Johnsbury & Lamoille County Railroad) and good cause appearing therefor:

It is ordered, That:

Revised I.C.C. Order No. 79 be, and it is hereby, amended by substituting the following paragraph (g) for paragraph (g) thereof:

(g) *Expiration date*. This order shall expire at 11:59 p.m., September 3, 1973, unless otherwise modified, changed, or suspended.

It is further ordered, That this amendment shall become effective at 11:59 p.m., July 15, 1973, and that this amendment shall be served upon the Association of American Railroads, Car Service Division, as agent of all railroads subscribing to the car service and car hire agreement under the terms of that agreement, and upon the American Short Line Railroad Association; and that it be filed with the Director, Office of the Federal Register.

Issued at Washington, D.C., July 6, 1973.

INTERSTATE COMMERCE COMMISSION,
[SEAL] R. D. PFAHLER, *Agent*.

[FR Doc.73-14565 Filed 7-16-73;8:45 am]

[Rev. S.O. 994, I.C.C. Order 103]

VERMONT RAILWAY, INC.

Rerouting or Diversion of Traffic

In the opinion of R. D. Pfahler, Agent, the Vermont Railway, Inc., is unable to transport traffic over its line between Rutland, Vermont, and White Creek, New York, because of bridge damage.

It is ordered, That:

(a) The Vermont Railway, Inc., being unable to transport traffic over its line between Rutland, Vermont, and White Creek, New York, because of bridge damage, that carrier is hereby authorized to reroute or divert such traffic via any available route to expedite the movement. The billing covering all such cars rerouted shall carry a reference to this order as authority for the rerouting.

(b) *Concurrence of receiving roads to be obtained*. The railroad desiring to divert or reroute traffic under this order shall receive the concurrence of other railroads to which such traffic is to be diverted or rerouted, before the rerouting or diversion is ordered.

(c) *Notification to shippers*. Each carrier rerouting cars in accordance with this order shall notify each shipper at the time each car is rerouted or diverted and shall furnish to such shipper the new routing provided under this order.

(d) Inasmuch as the diversion or rerouting of traffic is deemed to be due to carrier disability, the rates applicable to traffic diverted or rerouted by said Agent shall be the rates which were applicable at the time of shipment on the shipments as originally routed.

(e) In executing the directions of the Commission and of such Agent provided for in this order, the common carriers involved shall proceed even though no contracts, agreements, or arrangements now exist between them with reference to the division of the rates of transportation applicable to said traffic. Divisions shall be, during the time this order remains in force, those voluntarily agreed upon by and between said carriers; or upon failure of the carriers to so agree, said divisions shall be those hereafter fixed by the Commission in accordance with pertinent authority conferred upon it by the Interstate Commerce Act.

(f) *Effective date*. This order shall become effective at 9:00 a.m., July 2, 1973.

(g) *Expiration date*. This order shall expire at 11:59 p.m., July 31, 1973, unless otherwise modified, changed, or suspended.

It is further ordered, That this order shall be served upon the Association of American Railroads, Car Service Division, as agent of all railroads subscribing to the car service and car hire agreement under the terms of that agreement, and upon the American Short Line Railroad Association; and that it be filed with the Director, Office of the Federal Register.

Issued at Washington, D.C., July 2, 1973.

INTERSTATE COMMERCE COMMISSION,
[SEAL] R. D. PFAHLER, *Agent*.

[FR Doc.73-14562 Filed 7-16-73;8:45 am]

CUMULATIVE LISTS OF PARTS AFFECTED—JULY

The following numerical guide is a list of parts of each title of the Code of Federal Regulations affected by documents published to date during July.

3 CFR — Page

EXECUTIVE ORDERS:

11157 (amended by EO 11728) — 18861
11641 (revoked by EO 11727) — 18357
11676 (revoked by EO 11727) — 18357
11708 (amended by EO 11727) — 18357
11710 (amended by EO 11729) — 18863
11712 (superseded by 11726) — 17711
11726 — 17711
11727 — 18357
11728 — 18861
11729 — 18863

PROCLAMATIONS:

4228 — 17825
4229 — 19007

PRESIDENTIAL DOCUMENTS OTHER THAN PROCLAMATIONS AND EXECUTIVE ORDERS:

Memorandum of June 13 — 18231

5 CFR

213 — 17827, 18359, 18445, 18540, 18541
335 — 18445
430 — 18445
451 — 18446
630 — 18446
715 — 18446
900 — 17920

6 CFR

140 — 17489–17491, 17720, 17721, 18359, 18441, 18551–18553, 19046

7 CFR

15 — 17925
210 — 17722
215 — 17722
220 — 17723
225 — 17723
246 — 18447
250 — 17724
265 — 17724
270 — 17724
271 — 17845
295 — 17725
722 — 18451, 18452
401 — 17437, 18661
725 — 18233
864 — 18453
905 — 18026, 18360
908 — 17846, 18554
910 — 18027, 18661
911 — 18027, 18662
915 — 17437
921 — 18662
922 — 17846, 18554
923 — 18663
942 — 19009
944 — 17438, 18028
945 — 18865
958 — 18867
980 — 19010
1063 — 19012
1076 — 17439
1125 — 18234
1139 — 18234
1201 — 17725
1421 — 18663
1446 — 18453

7 CFR—Continued — Page

1464 — 18663
1823 — 17725

PROPOSED RULES:

70 — 18032
301 — 17501
725 — 18254
917 — 18469, 19047
925 — 18670
926 — 19047
930 — 19047
946 — 18670
947 — 17500, 18672
948 — 18672, 18898, 19047
1002 — 18033
1030 — 18672
1046 — 17733
1065 — 18035
1140 — 18681
1701 — 18383
1832 — 18040

8 CFR

100 — 17713
212 — 18868
214 — 18359
245 — 18359

9 CFR

71 — 18011, 18456
72 — 18011, 18541, 19012
73 — 18011, 18234
74 — 18011
76 — 17713, 18542
77 — 18012
78 — 18012
80 — 18012
82 — 18362
83 — 17439
314 — 18665
322 — 18868
331 — 18869
381 — 18869

PROPOSED RULES:

318 — 18682
319 — 18683
325 — 18682
381 — 18681

10 CFR

4 — 17927
50 — 19012
170 — 18443

PROPOSED RULES:

20 — 18908

12 CFR

201 — 19016
204 — 18869
217 — 18641
221 — 18363
226 — 18457, 18458
329 — 18543
500 — 19017
501 — 19017
526 — 18459
529 — 17929
545 — 17827, 18460, 18461
563 — 18461

PROPOSED RULES:

220 — 18690
222 — 18691

12 CFR—Continued — Page

PROPOSED RULES—Continued

225 — 18565
545 — 17738, 19051
561 — 19052
563 — 19052

13 CFR

107 — 17827
112 — 17933
113 — 17830
120 — 19021
123 — 18238
305 — 18869
306 — 18869
309 — 18869

PROPOSED RULE:

121 — 17850, 17851

14 CFR

21 — 17491
39 — 18243, 18244, 18442, 18641, 18870, 19024
61 — 17492
63 — 17492
65 — 17492
71 — 18244, 18245, 18363, 18442, 18642, 18643, 18870, 18871
91 — 17493, 19024
97 — 18012, 18544
103 — 17831
133 — 17493
137 — 17493
139 — 17714
141 — 17493
379 — 17935
1250 — 17936

PROPOSED RULES:

39 — 18684, 19048
71 — 17510, 17734, 17848, 18255, 18383–18385, 18470, 18563, 18685, 18904
75 — 17510, 18385
93 — 17511
121 — 19048
123 — 19048
127 — 19048
129 — 18255
135 — 19048
250 — 18471
288 — 17736
399 — 17736

15 CFR

8 — 17938
372 — 17814
375 — 17814
376 — 18467
377 — 17815, 18028, 18030, 18555
386 — 17815

16 CFR

4 — 18545
13 — 18364–18366, 18462, 18463, 18643–18651

FEDERAL REGISTER PAGES AND DATES—JULY

Pages	Date
17705-17817	July 3
17819-18004	5
18005-18223	6
18323-18349	9
18351-18432	10
18433-18523	11
18525-18634	12
18635-18853	13
18855-19000	16
19001-19103	17

federal register

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PART II

ENVIRONMENTAL PROTECTION AGENCY

■

CONTROL OF AIR POLLUTION FROM AIRCRAFT AND AIRCRAFT ENGINES

Emission Standards and Test Procedures for Aircraft

Title 40—Protection of Environment

CHAPTER I—ENVIRONMENTAL PROTECTION AGENCY

PART 87—CONTROL OF AIR POLLUTION FROM AIRCRAFT AND AIRCRAFT ENGINES

Emission Standards and Test Procedures for Aircraft

Section 231 of the Clean Air Act, as amended by Public Law 91-604, directs the Administrator of the Environmental Protection Agency to "establish standards applicable to emissions of any air pollutant from any class or classes of aircraft or aircraft engines which in his judgment cause or contribute to or are likely to cause or contribute to air pollution which endangers the public health or welfare." Regulations ensuring compliance with these standards are required to be issued by the Secretary of Transportation in accordance with section 232 of the Act.

Section 231 also directs the Administrator to conduct a study of the extent to which aircraft emissions affect air quality throughout the United States, and the technological feasibility of controlling such emissions. The report of such a study, "Aircraft Emissions: Impact on Air Quality and Feasibility of Control," has been published and copies of the report are available upon request free of charge from the Office of Public Affairs, Environmental Protection Agency, Washington, D.C. 20460.

On December 12, 1972, a notice of proposed rule making was published in the FEDERAL REGISTER (Volume 37, Number 239) which described standards limiting emissions from aircraft and aircraft engines. As required by section 231 of the Act, the Administrator held public hearings with respect to the proposed aircraft emission standards. One was held in Boston, Massachusetts, on January 29, 1973, and another in Los Angeles, California on February 6, 1973. Testimony was presented at these hearings by twenty-two representatives of domestic and foreign manufacturers and operators of aircraft and aircraft engines and other interested parties. Additional detailed comments were provided subsequent to the hearings by thirty-one organizations.

Consideration has been given to all relevant material presented and a number of amendments have been made to the regulations as proposed.

Changes have been made in the engine classification system. A separate class was created for turboprop engines because, after considering the comments, the proposed equivalency between shaft horsepower and jet thrust was not considered acceptable for all operating conditions over the landing/take off (LTO) cycle. Except for the creation of special classes for the JT3d and JT8D engines, which was done in order to require smoke retrofits on separate schedules, turbine engines over 8,000 lbs. thrust which power subsonic aircraft have been put into one class. This over-8,000 lbs. thrust class represents essentially all turbines used in commercial air transportation, except for the supersonic aircraft to be introduced during the next few years.

Based on testimony and comments during the public hearings, the engines which power supersonic transport aircraft are not technically capable of achieving as low emissions levels as other large turbine engines by using equivalent combustor design technology. The reasons for this include the following:

(1) Some such engines employ afterburners for thrust augmentation during take off and acceleration at cruising speeds. This type of device involves combustion at relatively low pressures in the engine tailpipe and consequent greater loss of hydrocarbons and carbon monoxide to the atmosphere.

(2) All such engines known to EPA operate at compressor ratios much lower than engines designed for subsonic aircraft. This means that at low speed, low altitude conditions, where the "ram" pressure rise is small, these engines burn more fuel, and hence emit greater total quantities of hydrocarbons and carbon monoxide than do the high pressure ratio subsonic engines. Comments demonstrated that this is a necessary design tradeoff to ensure that these engines achieve maximum efficiency (best possible fuel consumption) throughout a complete flight.

(3) In addition, the supersonic engines do not employ the high bypass ratio turbofan principle which contributes to the excellent fuel economy and low pollutant emission capability of the engines which power most large subsonic engines, since the relatively large diameter (or frontal areas) of this type of engine would cause excessive aerodynamic drag in aircraft flying at mach 2–3 flight speeds.

A separate class has been established for engines which power supersonic aircraft. Exhaust emission standards for this class will be based on the best available combustor design technology expected in 1979 and later, but with due consideration for the inherently higher emission characteristics of supersonic aircraft engines under landing/takeoff cycle conditions, as discussed above. These standards will represent the same level of emissions reduction from current supersonic aircraft, through application of the same types of combustor design technology, as will be required of subsonic aircraft, though the absolute hydrocarbon and carbon monoxide levels will be several times higher. Standards will be proposed for this class of engines within 60 days.

Consideration will also be given to development of ground handling procedures specifically applicable to supersonic aircraft which would further reduce their inherently greater pollution characteristics during operations at large metropolitan airports.

It is recognized by the EPA that potential problems have been identified relating to upper atmosphere effects of supersonic aircraft and to a lesser extent subsonic aircraft operations. The work in progress under the Department of Transportation Climatic Impact Assessment Program will be closely monitored by the EPA, in order that the present regulations can be adjusted if necessary. The present regulations are based on the need to control emissions occurring under 3,000 feet, to protect ambient air quality in urban areas.

The effective date for the completion of the JT3D smoke control retrofit has been delayed until 1978 to allow time for the development of the necessary new combustor components. This deferral is based upon the manufacturers' comments that the additional time is necessary to solve problems relating to component durability.

The proposed 1976 standards applicable to carbon monoxide and hydrocarbon emissions from newly manufactured turbine engines have been deleted. Deletion of the 1976 standards is based upon the manufacturers' comments that insufficient lead time is available to allow introduction of changes in all newly manufactured engines to achieve these levels by that date. To relax the standards to levels which could be achieved this quickly would eliminate any useful impact which they might have on ambient air quality. It was concluded that efforts could be more effectively directed toward achieving substantially greater emissions reductions than those proposed at a later point in time, i.e., 1979.

Following a detailed study of the comments plus consultation with the National Aeronautics and Space Administration and the Air Force, the originally proposed 1979 standards applicable to gas turbine engines have been revised to become essentially equivalent to emission levels being used as design goals by these two agencies in planned and current research and development projects. A new set of standards, applicable to newly certified large engines only, has been set for January 1, 1981, to reflect the introduction of the same types of advanced combustor design technology originally expected in 1979. The technology necessary to meet these 1981 standards is in an early development stage. EPA intends to monitor closely the development of this technology through programs sponsored both by other federal agencies and by industry. If it should become evident that the standards as promulgated cannot be achieved by the technology approaches explored in these programs, additional rule making action will be considered to ensure that the best technology available is reflected in the standards. These two changes respond to the many comments received which stated that the emissions reductions originally proposed for 1979 could not be achieved this quickly using currently known technology. It is estimated that approximately 6 years are needed to translate combustion research findings into production engines which are fully certified and flight tested for safe usage in aircraft.

The method for specifying smoke limits has been changed to reflect a sliding scale of values chosen to be proportional to thrust for engines to be produced after 1979. It now represents a more flexible approach than specifying an absolute number for an entire class of engines and is fundamentally sounder for application to future engine designs whose thrust characteristics are not known now. This change will better ensure that the actual visibility characteristics of the exhaust plumes from newly designed engines are within limits consistent with protection of the public welfare, i.e., protection of visibility and personal well-being.

The proposed standards controlling crankcase emissions from piston engine aircraft have been deleted because it has been concluded based on comments received that introduction of these systems could induce safety hazards and in any case would provide relatively little reduction in emissions. The exhaust emissions standards applicable to piston engines have been retained as proposed, effective for engines produced after December 31, 1979, to allow needed additional time for development. In addition, comments expressed concern over the safety of the measures expected to be used by the manufacturers of such engines to achieve the standards. Therefore, the EPA will monitor closely the development of the technology necessary to meet these 1980 standards. If it should become evident that the standards as promulgated cannot be achieved at that time by design techniques which are safe and in other respects airworthy, additional rule making action will be considered to ensure that the best technology available is reflected in the standards.

Many comments were received asking that EPA develop suitable correction factors for differences in ambient temperatures, pressures and humidity levels at locations where emissions testing would be carried out. The EPA is in agreement with the need to develop such factors, so as to allow for these influences, as is done in other EPA standards applicable to highway vehicles. Projects are being started to define these relationships so as to allow introduction of suitable correction factors as soon as possible.

In addition, the final rules contain other technical amendments and clarifying modifications to the testing and measurement procedures.

A number of additional basic criticisms of the proposed regulations were considered in the analysis which led to the revised standards, but were rejected for the reasons identified below:

Some commenters pointed out that the timing of the initially proposed standards was too late to be of any value to the states in their implementation plans aimed at meeting ambient air quality standards by 1975. However, consideration of other comments presented at the hearings plus information on the availability of emission reduction technology in the study accompanying the proposal, and consideration of the lead time necessary to introduce such technology into manufactured products and certify them for safety considerations, made it impossible to design standards to achieve meaningful air quality reductions which would be implemented any sooner than the regulations now specify.

Several commenters recommended that the Ringleman visual system for evaluating aircraft gas turbine smoke behavior should be substituted for the indirect filtration system described in the regulations, to facilitate direct correlation of the method used to certify engines with a technique which could be employed for enforcement purposes. Unfortunately, the Ringleman system is not suited to the precise evaluation of engine smoking characteristics. Moreover, during test cell operation, the plume cannot be viewed directly and its appearance is not the same as it would be under the conditions of altitude and visual contrast which exist in flight. Therefore the prescribed filter reflectance method and associated sampling systems have been retained.

Some commenters felt that the simulated landing/take-off cycle used as a basis for the numbers derived in the standards should be altered to make it more representative of an average LTO operation instead of reflecting peak traffic times at metropolitan air terminals. This comment was rejected, since the justification for the aircraft standards is largely based on protecting air quality in and around large metropolitan air terminals during adverse conditions. The short term National Ambient Air Quality Standards (40 CFR Part 50) are not written to be exceeded more than once per year. Thus the LTO cycle is based on typical adverse conditions.

Several commenters recommended that standards not be set at all for the 1979 and later period, pending the development of technology capable of achieving significant known emission reductions. EPA considers that the published standards will have a significant effect on stimulating the rate of progress of technological development and spur its rapid introduction into flight applications. The standards are based on NASA and Air Force-sponsored research already in progress, as well as engineering evaluations sponsored by EPA. The standards reflect reductions from present emission levels resulting from modified designs to existing engine components based on the application of known control technology. It should be emphasized that the standards set by EPA may reflect technology which may reasonably be obtained within a given time frame but which is not yet available. Section 231(b) of the Act expressly contemplates "*development* and application of the requisite technology" (emphasis added).

Commenters representing general aviation interests opposed the introduction of emission standards applicable to piston engine aircraft, on the grounds that compliance would require introductions of exhaust system reactors which would have drastic and costly effects on the configuration of the entire aircraft. The Agency has concluded that sufficient evidence is already available in the form of measured emissions data on current aircraft to indicate that the proposed standards can be met by improved fuel management and will not require exhaust system reactors.

A number of commenters felt that the report cited in the preamble to the proposed regulations had not adequately demonstrated a compelling need for emission standards applicable to aircraft. EPA does not feel that the minimal evidence offered by these commenters in support of their claim represents a valid basis for deciding that aircraft emissions do not contribute to air pollution endangering health or welfare in areas surrounding airports.

A new Part 87 of Title 40, Code of Federal Regulations, is hereby adopted and establishes:

(a) Fuel venting emission standards for new and in-use aircraft gas turbine engines.

(b) Exhaust emission standards for new and in-use aircraft gas turbine engines.

(c) Exhaust emission standards for new aircraft piston engines.

(d) Exhaust emission standards for new aircraft.

(e) Test procedures applicable to aircraft gas turbine engines and aircraft.

(f) A test procedure applicable to aircraft piston engines.

In judging the need for the regulations, the Administrator has determined (1) that the public health and welfare is endangered in several air quality control regions by violation of one or more of the national ambient air quality standards for carbon monoxide, hydrocarbons, nitrogen oxides, and photochemical oxidants, and that the public welfare is likely to be endangered by smoke emissions; (2) that airports and aircraft are now, or are projected to be, significant sources of emissions of carbon monoxide, hydrocarbons, and nitrogen oxides in some of the air quality control regions in which the national ambient air quality standards are being violated, as well as being significant sources of smoke; and therefore (3) that maintenance of the national ambient air quality standards and reduced impact of smoke emissions requires that aircraft and aircraft engines be subject to a program of control compatible with their significance as pollution sources. Accordingly, the Administrator has determined that emissions from aircraft and aircraft engines should be reduced to the extent practicable with present and developing technology. The standards proposed herein are not quantitatively derived from the air quality considerations discussed in the study report cited above but, instead, reflect EPA's judgment as to what reduced emission levels are or will be practicable to achieve for turbine and piston engines.

In general, the influence of the regulations, will be to contribute to the maintenance of the quality of the air in and around major air terminals throughout the post-1975 era in which air traffic is undergoing expansion. The timing of these standards is such that they will not make contributions to achievement of the ambient air pollution levels required by 1975 through the state implementation programs, although they will influence attainment of those levels where extensions until 1977 are granted for the ambient standards.

The total cost of these requirements to the airline industry is estimated at 141 million dollars over a ten year period. This represents for newly designated commercial engines an increase in cost of at most 3 percent. All equipment costs (including engines) used in commercial air transport account for only 13 percent of the airline ticket dollar. Thus, it is believed that imposition of the schedule of standards set forth in this regulation is too small to have any impact on the continued growth of air transportation in a fashion healthy and beneficial to the economy.

The standards promulgated for piston type aircraft are expected to result in significant fuel savings. (29 million dollars over ten years). The technology expected to be used to achieve 1979 and 1981 standards for turbines is not expected to result in fuel consumption penalties. Similarly, there is no inconsistency or conflict presently envisioned between the imposition of the above standards and the compliance of aircraft with noise control regulations during the same period.

It is intended that the attainment of any standards proposed herein not result in the increased emission of any substance for which a standard is not proposed if such emission could endanger public health or welfare. The Administrator intends to remain informed throughout engine and aircraft development and certification programs to permit him to determine at the earliest possible time if the emissions of a substance are likely to endanger the public health or welfare. Therefore, the Administrator may subsequently publish in the FEDERAL REGISTER a list of those substances whose emissions are liable to increase as a result of the installation or incorporation of any system or component, including fuel additives, designed to enable an aircraft or aircraft engine to conform to any prescribed standard. In the event such a list of substances is so published, appropriate testing and sampling methods and/or analytical techniques will be proposed under the normal rule making procedures after consultation with the Department of Transportation.

The standards contained in this notice are being promulgated after consultation with the Secretary of Transportation in order to assure appropriate consideration of aircraft safety. However, the Department of Transportation has advised that it is impossible to make conclusive judgments as to the effects of an emission standard on aircraft safety until engines designed to meet that standard have been developed, constructed, and tested. Therefore, there will be continuing consultation on this issue between this agency and that Department, both prior to and after promulgation of the standards. Should the Secretary of Transportation determine at any point that an emission standard cannot be met within the specified time without creating a safety hazard, appropriate modifications will be made to that standard or to its effective date.

(Section 231 of the Clean Air Act, as amended (42 U.S.C. 1857f-9))

Dated: July 6, 1973.

ROBERT W. FRI,
Acting Administrator.

In Title 40 of the Code of Federal Regulations, a new part, Part 87, is to be added as follows:

AUTHORITY: Sec. 231 of the Clean Air Act, as amended (42 U.S.C. 1857f-9).

Subpart A—General Provisions

§ 87.1 Definitions.

(a) As used in this part, all terms not defined herein shall have meaning given them in the Act:

(1) "Act" means the Clean Air Act, as amended by Public Law 91-604.

(2) "Administrator" means the Administrator of the Environmental Protection Agency to whom the authority involved may be delegated.

(3) "Aircraft" means any airplane for which a U.S. standard airworthiness certificate or equivalent foreign airworthiness certificate is issued.

(4) "Aircraft engine" means a propulsion engine which is installed in or which is manufactured for installation in an aircraft.

(5) "Aircraft gas turbine engine" means a turboprop, turbofan, or turbojet aircraft engine.

(6) "New aircraft gas turbine engine" means an aircraft gas turbine engine which has never been in service.

(7) "New aircraft piston engine" means an aircraft piston engine which has never been in service.

(8) "In-use aircraft gas turbine engine" and "in-use aircraft piston engine" mean an aircraft gas turbine engine or aircraft piston engine (as appropriate) which is in service.

(9) "Newly certified aircraft gas turbine engine" means an aircraft gas turbine engine which is originally type certified on or after the effective date of the applicable emission standard.

(10) "Rated power" means the maximum power/thrust available for takeoff at standard day conditions as approved for the engine by the Federal Aviation Administration.

(11) "Standard day conditions" means standard ambient conditions as described in the United States Standard Atmosphere, 1962, (i.e., temperature=59°F, relative humidity=0%, and pressure=29.92 inches Hg).

(12) "Power setting" means the power output of an engine in terms of pounds thrust for turbojet and turbofan engines and shaft horsepower for turboprop and piston engines.

(13) "Pound-thrust/hr." means pounds of thrust for 1 hour.

(14) "Shaft horsepower" means only the measured shaft power output of an auxiliary power unit, turboprop, or piston engine.

(15) "Auxiliary power unit" means any engine installed in or on an aircraft exclusive of the propulsion engines.

(16) "Class T1" means all aircraft turbofan or turbojet engines except engines of Class T5 of rated power less than 8,000 pounds thrust.

(17) "Class T2" means all turbofan or turbojet aircraft engines except engines of Class T3, T4, and T5 of rated power of 8,000 pounds thrust or greater.

(18) "Class T3" means all aircraft gas turbine engines of the JT3D model family.

(19) "Class T4" means all aircraft gas turbine engines of the JT8D model family.

(20) "Class T5" means all aircraft gas turbine engines employed for propulsion of aircraft designed to operate at supersonic flight speeds.

(21) "Class P1" means all aircraft piston engines, except radial engines.

(22) "Class P2" means all aircraft turboprop engines.

(23) "Taxi/idle (in)" means those aircraft operations involving taxi and idle between the time of landing roll-out and final shutdown of all propulsion engines.

(24) "Taxi/idle (out)" means those aircraft operations involving taxi and idle between the time of initial starting of the propulsion engine(s) used for the taxi and turn onto duty runway.

(25) "Exhaust emissions" means substances emitted to the atmosphere from the exhaust discharge nozzle of an aircraft or aircraft engine.

(26) "Fuel venting emissions" means all raw fuel, exclusive of hydrocarbons in the exhaust emissions, discharged from aircraft gas turbine engines during all normal ground and flight operations.

(27) "Smoke" means the matter in exhaust emissions which obscures the transmission of light.

(28) "Smoke number (SN)" means the dimensionless term quantifying smoke emissions.

(29) "Oxides of nitrogen" means the sum of the amounts of the nitric oxide and nitrogen dioxide contained in a gas sample as if the nitric oxide were in the form of nitrogen dioxide.

(30) "Calibration gas" means a gas of known concentration which is used to establish the response curve of an analyzer.

(31) "Span gas" means a gas of known concentration which is used routinely to set the output level of an analyzer.

§ 87.2 Abbreviations.

The abbreviations used in this part have the following meanings in both upper and lower case:

abs.	Absolute.
APU	Auxiliary power unit.
ASA	American Standards Association.
ASTM	American Society for Testing and Materials.
b.hp.	Brake horsepower.
c.f.h.	Cubic feet per hour.
c.f.m.	Cubic feet per minute.
C.	Centigrade.
cc.	Cubic centimeter.
CO_2	Carbon dioxide.
CO	Carbon monoxide.
EPR	Engine pressure ratio.
F.	Fahrenheit.
FAA	Federal Aviation Administration, Department of Transportation.
FID	Flame ionization detector.
H/C	Hydrogen to carbon atomic ratio.
HC	Hydrocarbon(s).
Hg	Mercury.
hp.	Horsepower.
hp.-hr.	Horsepower-hr.
hr.	Hour(s).
in.HgV.	Inches of mercury, vacuum.
I.D.	Inside diameter.
lb.	Pound(s).
LTO	Landing takeoff.
min.	Minute(s).
mm.	Millimeter(s).
N_1	First-stage rotor speed.
N_2	Second-stage rotor speed or nitrogen (as applicable).
N_3	Third-stage rotor speed.
NO	Nitric oxide.
NO_2	Nitrogen dioxide.
NO_x	Oxides of nitrogen, NO and NO_2.
NDIR	Nondispersive infrared analyzer.
O_2	Oxygen.
O_3	Ozone.
p.p.m	Parts per million by volume.
p.p.m.C	Parts per million carbon.
PT_7	Total pressure at station 7.
R.	Rankine.
r.p.m.	Revolutions per minute.
s.c.f.h.	Standard cubic feet per hour.
s.c.f.m.	Standard cubic feet per minute.
sec.	Second(s).
SHP	Shaft horsepower
SN	Smoke number.
TIM	Time in mode.
TT	Total temperature at station 7.
°	Degree.
%	Percent.

§ 87.3 General requirements.

(a) This part provides for the approval or acceptance by the Administrator or his agents of testing and sampling methods, analytical techniques, and related equipment not identical to those specified in this part. Before he approves or accepts any such alternate, equivalent, or otherwise nonidentical procedures or equipment, the Administrator shall consult with the Secretary of Transportation in determining whether or not the action requires rule making under sections 231 and 232 of the Clean Air Act, as amended, consistent with the Secretary's responsibilities under section 232 of the Act.

(b) Under section 232 of the Act, the Secretary of Transportation issues regulations to insure compliance with this part and all amendments thereof.

(c) With respect to aircraft of foreign registry, these regulations shall apply in a manner consistent with any obligation assumed by the United States in any treaty, convention or agreement between the United States and any foreign country or foreign countries.

§ 87.4 Test conditions.

The complete engine as configured for final acceptance testing, including all accessories which might reasonably be expected to influence emissions to the atmosphere excluding auxiliary gearbox-mounted components required to drive aircraft systems and service air bleed, shall be functional for all testing in this part.

§ 87.5 Special test procedures.

The Administrator may, upon written application by a manufacturer or operator of aircraft or aircraft engines, prescribe test procedures for any aircraft or aircraft engine that is not susceptible to satisfactory testing by the procedures set forth herein. Prior to taking action on any such application, the Administrator shall consult with the Secretary of Transportation.

§ 87.6 Aircraft safety.

The provisions of this part will be revised if at any time the Secretary of Transportation determines that an emission standard cannot be met within the specified time without creating a safety hazard.

Subpart B—Engine Fuel Venting Emissions (New and In-Use Aircraft Gas Turbine Engines)

§ 87.10 Applicability.

The provisions of this subpart are applicable to each new aircraft gas turbine engine of classes T2, T3, T4, and T5 manufactured on or after January 1, 1974, and all in-use aircraft gas turbine engines of classes T2, T3, T4, and T5 beginning January 1, 1974, and each new aircraft gas turbine engine of Classes T1 and P2 manufactured on or after January 1, 1975 and all in-use aircraft gas turbine engines of classes T1 and P2 beginning January 1, 1975.

§ 87.11 Standard for fuel venting emissions.

(a) No fuel venting emissions shall be discharged into the atmosphere from any new or in-use gas turbine engine subject to the subpart.

(b) Conformity with the standard set forth in paragraph (a) shall be determined by inspection of the method designed to eliminate these emissions.

Subpart C—Exhaust Emissions (New Aircraft Gas Turbine Engines)

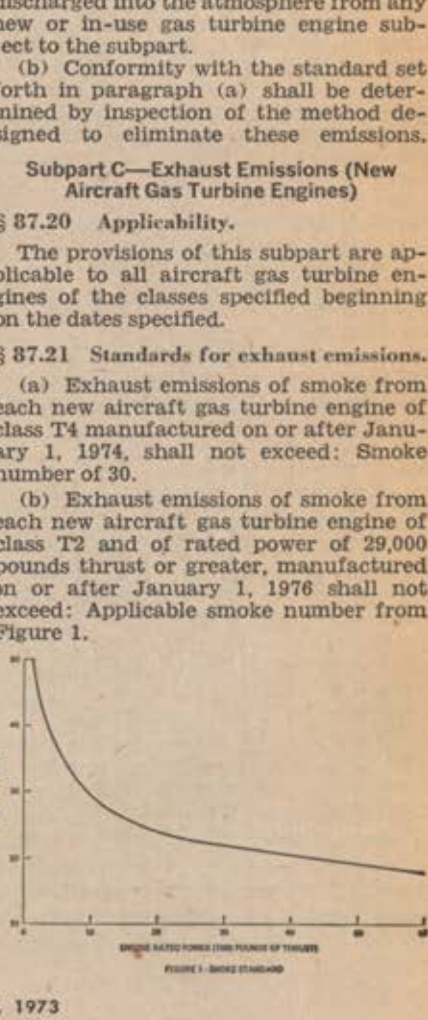
§ 87.20 Applicability.

The provisions of this subpart are applicable to all aircraft gas turbine engines of the classes specified beginning on the dates specified.

§ 87.21 Standards for exhaust emissions.

(a) Exhaust emissions of smoke from each new aircraft gas turbine engine of class T4 manufactured on or after January 1, 1974, shall not exceed: Smoke number of 30.

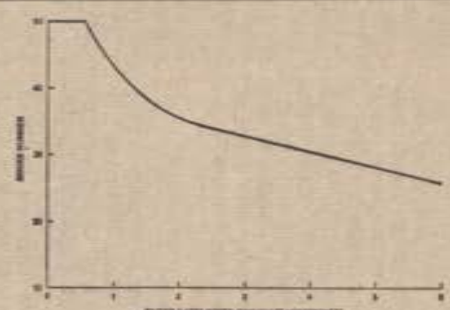
(b) Exhaust emissions of smoke from each new aircraft gas turbine engine of class T2 and of rated power of 29,000 pounds thrust or greater, manufactured on or after January 1, 1976 shall not exceed: Applicable smoke number from Figure 1.



(c) Exhaust emissions of smoke from each new aircraft gas turbine engine of class T3 manufactured on or after January 1, 1978 shall not exceed: smoke number of 25.

(d) Exhaust emissions from each aircraft gas turbine engine of the classes specified below manufactured on or after January 1, 1979, shall not exceed:

(1) Class T1:	
(i) Hydrocarbons	1.6 pounds/1,000 pound-thrust hours/cycle
(ii) Carbon monoxide	9.4 pounds/1,000 pound-thrust hours/cycle
(iii) Oxides of nitrogen	3.7 pounds/1,000 pound-thrust-hours cycle
(iv) Smoke	Smoke number from Figure 1.
(2) Class T2, T3, or T4:	
(i) Hydrocarbons	0.8 pound/1,000 pound-thrust hours/cycle
(ii) Carbon monoxide	4.3 pounds/1,000 pound-thrust hours/cycle
(iii) Oxides of nitrogen	3 pounds/1,000 pound-thrust hours/cycle
(iv) Smoke	Smoke number from Figure 1.



(3) Class P2:	
(i) Hydrocarbons	4.9 pounds/1,000 horsepower-hours/cycle
(ii) Carbon monoxide	26.8 pounds/1,000 horsepower-hours/cycle
(iii) Oxides of nitrogen	12.9 pounds/1,000 horsepower-hours/cycle
(iv) Smoke	Smoke number from Figure 2.

(4) The smoke number for each engine shall be determined by obtaining the smoke number corresponding to the engine rated power from Figure 1 for turbofan or turbojet engines and Figure 2 for turboprop engines.

(e) Exhaust emissions from each newly certified aircraft gas turbine engine of Classes T2, T3, or T4 manufactured on or after January 1, 1981, shall not exceed:

(i) Hydrocarbons	0.4 pound/1,000 pound-thrust hours/cycle

(f) The standards set forth in paragraphs (a), (b), (c), (d), and (e) of this section refer to a composite gaseous emission sample representing the operating cycles set forth in the applicable sections of Subpart G of this part, and exhaust smoke emissions emitted during operations of the engine as specified in the applicable sections of subpart H of this part, and measured and calculated in accordance with the procedures set forth in those subparts.

Subpart D—Exhaust Emissions (In-Use Aircraft Gas Turbine Engines)

§ 87.30 Applicability.

The provisions of this subpart are applicable to all in-use aircraft gas turbine engines certified for operation within the United States of the classes specified beginning on the dates specified.

(ii) Carbon monoxide	3 pounds/1,000 pound-thrust hours/cycle
(iii) Oxides of nitrogen	3 pounds/1,000 pound-thrust hours/cycle
(iv) Smoke	Smoke number from Figure 1.

§ 87.31 Standards for exhaust emissions.

(a) Exhaust emissions of smoke from each in-use aircraft gas turbine engine of Class T4, beginning January 1, 1974, shall not exceed: Smoke number of 30.

(b) Exhaust emissions of smoke from each in-use aircraft gas turbine engine of class T2 and of rated power of 29,000 pounds thrust or greater, beginning January 1, 1976, shall not exceed: Applicable Smoke number from Figure 1.

(c) Exhaust emissions of smoke from each in-use aircraft gas turbine engine of class T3, beginning January 1, 1978 shall not exceed: Smoke number of 25.

(d) The standards set forth in paragraphs (a), (b), and (c) of this section refer to exhaust smoke emissions emitted during operations of the engine as specified in the applicable sections of Subpart H of this part, and measured and calculated, in accordance with the procedures set forth in this subpart.

(e) In addition to the requirements imposed by paragraphs (a), (b), and (c) of this section, each in-use aircraft gas turbine engine shall not exceed the level of the emissions applicable to such engine when it was new.

Subpart E—Exhaust Emissions (New and In-Use Aircraft Piston Engines)

§ 87.40 Applicability.

The provisions of this subpart are applicable to all aircraft piston engines of class P1 beginning on the date specified.

§ 87.41 Standards for exhaust emissions (new aircraft piston engines).

(a) Exhaust emissions from each new aircraft piston engine manufactured on or after December 31, 1979, shall not exceed:

(i) Hydrocarbons	0.00190 pound/rated power/cycle
(ii) Carbon monoxide	0.042 pound/rated power/cycle
(iii) Oxides of nitrogen	0.0015 pound/rated power/cycle.

(b) The standards set forth in paragraph (a) of this section refer to a composite gaseous exhaust emission sample representing the operating cycle set forth in the application sections of Subpart I of this part and measured and calculated in accordance with the procedures set forth in that subpart.

§ 87.42 Standards for exhaust emissions (in-use aircraft piston engines).

Exhaust emissions from each in-use aircraft piston engine manufactured on or after January 1, 1979, shall not exceed the level applicable to such engine when it was new.

Subpart F—Exhaust Emissions (New and In-Use Aircraft)

§ 87.50 Applicability.

The provisions of this subpart are applicable to all aircraft beginning on the date specified.

§ 87.51 Standards for exhaust emissions (new aircraft).

(a) Exhaust emissions resulting from the generation of onboard power from each new aircraft manufactured on or after January 1, 1979, shall not exceed:

(i) Hydrocarbons	0.4 pound/1,000 hp.-hr. of power output
(ii) Carbon monoxide	5 pounds/1,000 hp.-hr. of power output
(iii) Oxides of nitrogen	3 pounds/1,000 hp.-hr. of power output.

(b) The standards set forth in paragraph (a) of this section refer to exhaust emissions from new aircraft exclusive of the exhaust, crankcase, and fuel venting emissions from the propulsion engines mounted on such aircraft.

(c) In determining conformity of aircraft with the standards set forth in paragraph (a) of this section, all auxiliary power units shall be operated under the conditions set forth in the applicable sections of Subpart G of this part and emissions measured and calculated in accordance with those procedures.

§ 87.52 Standards for exhaust emissions (in-use aircraft).

Exhaust emissions from each in-use aircraft manufactured on or after January 1, 1979, resulting from generation of onboard power shall not exceed the level of the emission standards applicable to such aircraft when it was new.

Subpart G—Test Procedures for Engine Exhaust Gaseous Emissions (Aircraft and Aircraft Gas Turbine Engines)

§ 87.60 Introduction.

Except as provided under § 87.5, the procedures described in this subpart shall be the test program to determine the conformity of new and in-use aircraft gas turbine engines with the applicable standards set forth in this part. The procedures shall also be used to determine emissions from auxiliary power units in determining conformity of new and in-use aircraft with the applicable standards set forth in this part.

(a) The test consists of operating the engine at prescribed power settings on an engine dynamometer (for engines producing primarily shaft horsepower) or thrust measuring test stand (for engines producing primarily thrust). The exhaust gases generated during engine operation are sampled continuously for specific component analysis through the analytical train.

(b) The exhaust emission test is designed to measure hydrocarbons, carbon monoxide, carbon dioxide, and oxides of nitrogen concentrations and determine mass emissions and engine work output through calculations during a simulated aircraft landing-takeoff cycle (LTO). The LTO cycle is based on time in mode data during high activity periods at major airports. The test for propulsion engines consists of at least the following five modes of engine operation: Taxi/idle (out), takeoff, climbout, approach, and taxi/idle (in). The mass emission and work output for the modes are combined to yield the reported values. The test for auxiliary power units consists of one mode: Full load.

(c) When an engine is tested for exhaust emissions on an engine dynamometer or test stand, the complete engine shall be used with all accessories which might reasonably be expected to influence emissions to the atmosphere installed and functioning but excluding auxiliary gearbox-mounted components required to drive aircraft systems and service air bleed.

§ 87.61 Turbine fuel specifications.

For exhaust emission testing, fuel meeting the specifications, ASTM D1655-latest version-Jet A. shall be used. Nonmetallic additives as specified in ASTM D1655-latest version-Jet A. may be present. Additives used for the purpose of smoke suppression (such as organometallic compounds) shall not be present.

§ 87.62 Test procedure (propulsion engines).

(a) (1) The engine shall be tested in each of the following five engine operating modes which simulate aircraft operation to determine its mass emission rates and work output.

Actual power setting, that when corrected to standard day conditions, corresponds to the following percentage of rated power.

Mode	Class T1 or P2	Class T2, T3, or T4
Taxi/idle (out)	See subparagraph (2) of this paragraph.	
Takeoff	100	100
Climbout	90	85
Approach	30	30
Taxi/idle (in)	See subparagraph (2) of this paragraph.	

(2) The taxi/idle operating modes shall be carried out at a power setting in accordance with applicable Federal Aviation Administration regulations, at the manufacturer's recommended power setting for idle.

(b) Emission testing shall be conducted on warmed-up engines which have achieved a steady operating temperature.

§ 87.63 Test procedure (auxiliary power units)

(a) In determining compliance with the aircraft emission standards under Subpart F of this part, each auxiliary power unit shall be tested at its maximum load condition as indicated by its power output, exhaust gas temperature, or turbine inlet temperature to determine its mass emission rate and work output. The work output shall be determined as a combination of shaft energy output and actual bleed air energy content. The bleed air equivalent horsepower for APU's shall be determined as follows:

Work Output $= 0.341W\ (T_{bleed} - T_{in})$, where W = bleed airflow in lbs/sec, T_{bleed} = measured bleed air temperature in °F, and T = compressor inlet temperature in °F.

(b) Emission testing shall be conducted on warmed-up auxiliary power units which have achieved a steady operating temperature.

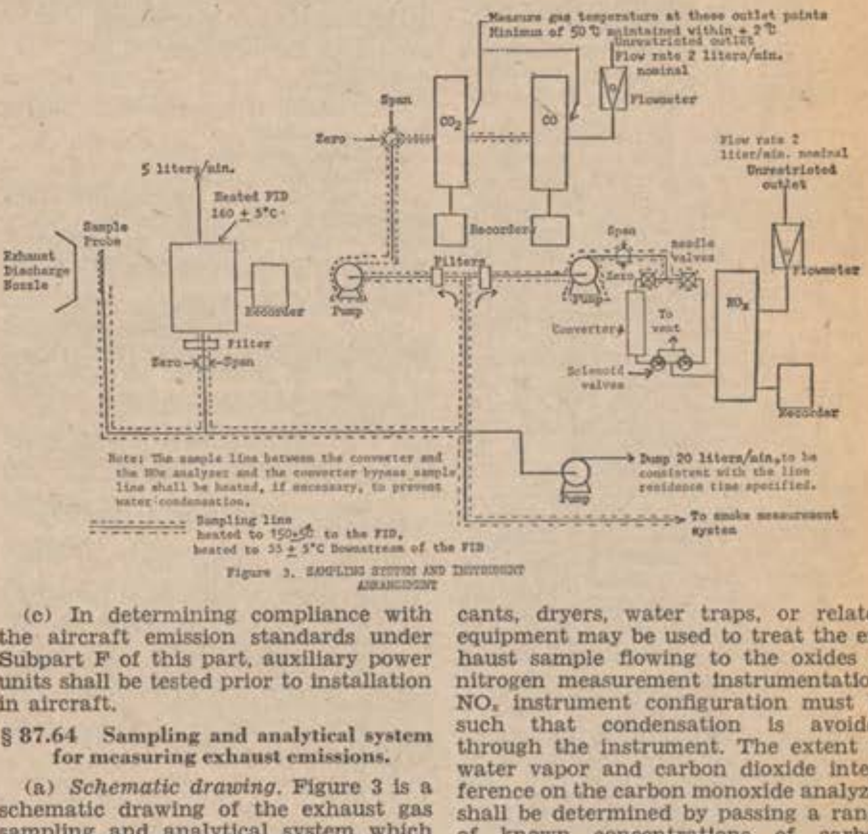


Figure 3. SAMPLING SYSTEM AND INSTRUMENT ARRANGEMENT

(c) In determining compliance with the aircraft emission standards under Subpart F of this part, auxiliary power units shall be tested prior to installation in aircraft.

§ 87.64 Sampling and analytical system for measuring exhaust emissions.

(a) *Schematic drawing.* Figure 3 is a schematic drawing of the exhaust gas sampling and analytical system which shall be used for testing under the regulations in this subpart. Additional components such as instruments, valves, solenoids, pumps, and switches may be used to provide additional information and coordinate the functions of the component systems. Parallel installation of CO and CO_2 instruments are an acceptable alternate configuration of Figure 3.

(b) *Water removal devices.* No desiccants, dryers, water traps, or related equipment may be used to treat the exhaust sample flowing to the oxides of nitrogen measurement instrumentation. NO_x instrument configuration must be such that condensation is avoided through the instrument. The extent of water vapor and carbon dioxide interference on the carbon monoxide analyzer shall be determined by passing a range of known concentrations of carbon dioxide and water vapor through the instrument and observing the response. If the effect is greater than 2 percent of measured CO levels, all subsequent measurements shall be corrected for these interferences.

(c) *Component description (exhaust gas sampling system).* The following components shall be used in the exhaust gas sampling system for testing under the regulations in this subpart.

(1) *Sampling probe.* (i) Probe design concept: The probe shall be made of stainless steel. If a mixing probe is used, all sampling holes shall be of equal diameter. Total probe orifice area shall be such that the principal pressure drop (at least 80 percent) through the probe assembly shall be taken at the orifice (or orifices).

(ii) Probe orientation and sampling location:

(*a*) A minimum of 12 sampling points shall be used. Either mixing or individual probes are acceptable.

(*b*) A minimum of three different radial positions shall be used in each of four sampling quadrants.

(*c*) If the minimum of 12 sampling points are used, the points in circumferentially adjacent sampling areas shall be separated in any direction by a distance less than 0.1 tailpipe radius or 0.1 annular height, as applicable. If the number of sampling points (n) is greater than 12, they shall be equal in number in each quadrant or sector and the minimum separations specified above shall be reduced by a factor = 12/n.

(*d*) The axial sampling plane shall be as close to the plane of the exit nozzle as engine performance parameters permit but in any case, shall be within one exit nozzle diameter of the exit plane.

(*e*) In all cases, the probe shall be designed to obtain a representative sample over the area of the entire exhaust nozzle, on both mixed fan engines and nonmixed fan engines as well as turbojets, turboprops and auxiliary power engines.

(*f*) The multipoint probe shall be designed to minimize the errors due to pollutant stratification, whether the stratification is due to combustor design, mixing or lack of mixing, or engine design such as mixing of fan and core air.

(2) *Sample transfer.* The sample shall be transferred from the probe to the analytical instruments through a heated sample line of either stainless steel or Teflon of 0.18- to 0.32-in. I.D. The sample lines shall be maintained at a temperature of 150°±5° C. Sample flow rate from the engine to the instruments is 2 sec. or less. The sample line length from the probe exit to the instruments shall be of minimum length, but in no case greater than 80 feet.

(d) *Component description (exhaust gas analytical system).* The following components shall be used in the exhaust gas analytical system for testing under the regulations in this subpart. The analytical system provides for the determination of hydrocarbon concentrations by flame ionization detector analysis, the determination of carbon monoxide and carbon dioxide concentrations by nondispersive infrared analysis and the determination of oxides of nitrogen concentrations by chemiluminescence analysis of exhaust samples. The chemiluminescence method of analysis requires that the nitgrogen dioxide present in the sample be converted to nitric oxide before analysis. Other types of analyzers may be used if shown to yield equivalent results and if approved in advance by the Administrator. See Appendix A of this part.

§ 87.65 Information to be recorded.

The following information, as applicable, shall be recorded with respect to each test.

(a) *General.* (1) Facility performing test.

(2) Description of test equipment including the probe and sampling and analytical train.

(3) Instrument operator.

(4) Test stand operator.

(5) Fuel identification, including H/C ratio and additives, if any.

(b) *Aircraft (in which engine will be installed) description.* (1) Manufacturer.

(2) Model number.

(3) Serial number (if known).

(4) User.

(5) Engine installation position.

(c) *Engine description.* (1) Manufacturer.

(2) Model number.

(3) Serial number.

(4) Time since overhaul and other pertinent maintenance information.

(d) *Test data.* (1) Test number.

(2) Date.

(3) Time.

(4) Ambient temperature and engine inlet temperature.

(5) Barometric pressure.

(6) Relative humidity.

(7) Sample line temperature. Line temperature shall be taken at a minimum of three locations, two of which shall be the probe outlet and instrumentation inlet.

(8) Sample line residence time.

(9) All pertinent instrument information such as tuning, gain, full scale range.

(10) Recorder charts: Identify zero, span, exhaust gas sample traces, and operating mode.

(11) Date of most recent analytical assembly calibration and identification number, if any.

(e) *Operating mode data.* (1) Nominal power setting.

(2) Actual power setting (pounds, thrust, horsepower, etc.).

(3) N_1 speed, revolutions per minute.

(4) N_2 speed and N_3, if applicable, revolutions per minute.

(5) Measured fuel flow, pounds/hour.

(6) Air flow, pounds/second and method of determination.

(7) Bleed air flow, pounds/second and pressure (APU's only).

(8) PT_7.

(9) EPR.

(10) TT_7.

(11) Pollutant concentration, from recorders, in percent or parts per million by volume, and parts per million carbon for hydrocarbons.

§ 87.66 Calibration and instrument checks.

(a) Calibrate the analytical assembly at least once every 30 days. Use the same flow rate as when analyzing samples.

(1) Adjust analyzers to optimize performance.

(2) Zero the hydrocarbon analyzer with zero grade air and the carbon monoxide, carbon dioxide, and oxides of nitrogen analyzers with zero grade nitrogen. The allowable zero gas impurity concentrations should not exceed 0.1 p.p.m. equivalent carbon response, 1 p.p.m. carbon monoxide, 350 p.p.m. carbon dioxide, and 0.1 p.p.m. nitric oxide.

(3) Set the CO and CO_2 analyzer gains to give the desired range. Select desired attenuation scale of the HC analyzer and adjust the electronic gain control to give the desired full scale range. Select the desired scale of the NO_x analyzer and adjust the phototube high voltage supply or amplifier gain to give the desired range.

(4) Calibrate the HC analyzer with propane (air diluent) gases having nominal concentrations equal to 50 and 95 percent of full scale of each range used. Calibrate the CO analyzer with carbon monoxide (nitrogen diluent) gases and the CO_2 analyzer with carbon dioxide (nitrogen diluent) gases having nominal concentrations equal to 30, 60, and 90 percent of full scale of each range used. Calibrate the NO_x analyzer with nitric oxide (nitrogen diluent) gases having nominal concentrations equal to 50 and 95 percent of full scale of each range used. The actual concentrations should be known to within ±2 percent of the true values.

(5) Compare values obtained on the CO and CO_2 analyzers with previous calibration curves. Any significant change reflects some problem in the system. Locate and correct problem, and recalibrate. Use best judgment in selecting curves for data reduction. Log gain reading.

(6) Check the NO_x to NO converter efficiency by the following procedure. Use the apparatus described and illustrated in Figure 4.

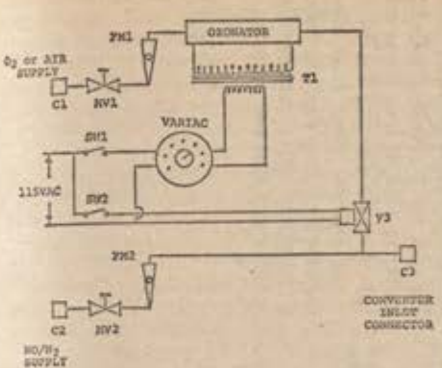
(i) Attach the NO/N_2 supply (150–250 p.p.m.) at C_2, the O_2 supply at C_1 and the analyzer inlet connection to the efficiency detector at C_3. If lower concentrations of NO are used, air may be used in place of O_2 to facilitate better control of the NO_2 generated during step (iv).

(ii) With the efficiency detector variac off, place the NO_x converter in bypass mode and close valve V3. Open valve MV2 until sufficient flow and stable readings are obtained at the analyzer. Zero and span the analyzer output to indicate the value of the NO concentration being used. Record this concentration.

(iii) Open valve V3 (on/off flow control solenoid valve for O_2) and adjust valve MV1 (O_2 supply metering valve) to blend enough O_2 to lower the NO concentration (ii) about 10%. Record this concentration.

(iv) Turn on the ozonator and increase its supply voltage until the NO concentration of (iii) is reduced to about 20% of (ii). NO_2 is now being formed from the $NO+O_3$ reaction. There must always be at least 10% unreacted NO at this point. Record this concentration.

FIGURE 4 — NO_x CONVERTER EFFICIENCY DETECTOR



(v) When a stable reading has been obtained from (iv), place the NOx converter in the convert mode. The analyzer will now indicate the total NOx concentration. Record this concentration.

(vi) Turn off the ozonator and allow the analyzer reading to stabilize. The mixture NO+02 is still passing through the converter. This reading is the total NOx concentration of the dilute NO span gas used at step (iii). Record this concentration.

(vii) Close valve V3. The NO concentration should be equal to or greater than the reading of (ii) indicating whether the NO contains any NO_2.

Calculate the efficiency of the NOx converter by substituting the concentrations obtained during the test into the following equation.

$$\% \text{ Eff.} = \frac{(v) - (iv)}{(vi) - (iv)} \times 100\%$$

The efficiency of the conventer should be greater than 90 percent. Adjusting the converter temperature may be needed to maximize the efficiency. Efficiency checks should be made on each analyzer range using an NO span gas concentration appropriate to the instrument range.

(viii) If the converter efficiency is not greater than 90 percent, the cause of the inefficiency shall be determined and corrected before the instrument is used.

(ix) The converter efficiency shall be checked at least once weekly and preferably once daily.

(b) Verifications and instrument checks shall be performed in accordance with § 87.67 on in-use systems. Verification and instrument checks shall be performed before and after each test, but not less than once per hour.

(c) For the purposes of this section, the term "zero grade air" includes artificial "air" consisting of a blend of nitrogen and oxygen with oxygen concentrations between 18- and 21-mole percent.

§ 87.67 Sampling procedures.

(a) *HC, CO, CO_2, and NOx measurements.* Allow a minimum of 2 hours warmup for the CO, CO_2, HC, and NOx analyzers. (Power is normally left on infrared and chemiluminescence analyzers; but when not in use, the chopper motors of the infrared analyzers are turned off and the phototube high voltage supply of the chemiluminescence analyzer is placed in the standby position.) The following sequence of operations shall be performed in conjunction with each series of measurements:

(1) Check the sampling system for any leaks that could dilute the exhaust gas and replace or clean sample line filters.

(2) Introduce the zero grade gas at the same flow rates used to analyze the test samples and zero the analyzers. Obtain a stable zero on each amplifier meter and recorder. Recheck after tests.

(3) Introduce span gases and set the CO and CO_2 analyzer gains, the HC analyzer sample capillary flow rate and electronic gain control, if provided, and the NOx analyzer high voltage supply or amplifier gain to match the calibration curves. In order to avoid corrections, span and calibrate at the same flow rates used to analyze the test samples. Span gases should have concentrations equal to approximately 80 percent of each range used. If gain has shifted significantly on the CO or CO_2 analyzers, check tuning. If necessary, check calibration. Respan at least at end of test but not less than once per hour. Show actual concentrations on chart. Log gain readings.

(4) Check zeros; repeat the procedure in subparagraphs (1) and (2) of this paragraph, if required.

(5) Check sample line temperature and sample residence time. To check sample residence time:

(i) Introduce HC span gas into sampling system at sample inlet and simultaneously start timer.

(ii) When HC instrument indication is 15 percent of span concentration, stop timer.

(iii) If elapsed time is more than 2.0 seconds, make necessary adjustments.

(iv) Repeat (i) through (iii) with CO, CO_2, and NO instruments and span gases.

(6) Check instrument flow rates and pressures.

(7) The engine shall be operated in each operating mode until emission levels have stabilized as indicated by a constant instrument reading or recorder output. This stabilized reading shall be recorded and used in calculating mass emission rates as called for in Section 87.70.

(8) Measure, HC, CO, CO_2, and NOx concentrations of the exhaust sample at the various modes called for in §§ 87.62 or 87.63, as appropriate.

(9) If individual probes are used, the number to be reported (for each component) shall be the arithmetic average of the values obtained at each sampling point. If mixing probes are used, the number to be reported shall be the average of the values of the several probes, giving each probe a weighting factor equal to the number of sample points in that particular probe.

(10) Recheck zero and span points at the end of the test and also at approximately one hour intervals during the test. If either has changed by ±2 percent of full scale, the test shall be rerun after instrument maintenance: *Provided*, That if it is impractical to repeat the test, a correction based on an interpolation which is linear with time is acceptable for corrections within ±4 percent.

(b) *Sample system contamination.* (1) Care shall be taken to avoid loading of the sampling system with raw fuel discharge during engine starting.

(2) When the sample probe is in the exhaust stream and sampling is not in process, a back purge with air or an inert gas may be necessary to protect the probe and sample line from particulate buildup which could affect smoke and hydrocarbon readings. Check sample line for contamination each time the instrument zero and span points are checked. Use the following procedure to check the sample line:

(i) Immediately after instrument zero and span measurements and necessary adjustments are complete, introduce hydrocarbon zero gas near the sample probe. If the instrument zero reading increases by more than 5 percent of the scale in use, the sample line shall be purged or cleaned as required, to bring the zero within limits.

(ii) When the requirements of (i) have been met, introduce hydrocarbon span gas into the inlet of the sampling system. If the instrument span reading is different by more than ±5 percent from the correct setting for the scale in use, the sample line shall be purged or cleaned, as required, to bring the span within limits.

§ 87.68 Test run.

A test run shall consist of operating the engine in accordance with §§ 87.62 or 87.63, as applicable. During the test run, the engine shall not be operate at a power setting above normal idle power before beginning the test sequence of § 87.62. The engine shall be operated in the sequence called for under these sections, unless an alternate procedure is agreed to in writing by the Administrator before such testing is conducted. If repeat runs at full takeoff power are necessary, they may be conducted after the last idle run in the test sequence.

§ 87.69 Chart reading.

Determine the HC, CO, CO_2, and NOx concentrations of the exhaust sample during the various modes from the instrument deflections or recordings, making use of appropriate calibration charts.

§ 87.70 Calculations.

(a) The final reported test results shall be computed by use of the following formulas:

(1) Hydrocarbon:

$$\frac{\text{HC pounds/1,000 pound-thrust-hrs. or}}{\text{1,000 hp.-hr., as appropriate/cycle}} = \frac{\text{Sum of the HC mass/mode of ea. mode}}{\text{Sum of the work output of ea. mode}}$$

(2) Carbon monoxide:

$$\text{CO pounds/1,000 pound-thrust hrs. or } \frac{}{1{,}000 \text{ hp.-hr., as appropriate/cycle}} = \frac{\text{Sum of the CO mass/mode of ea. mode}}{\text{Sum of the work output of ea. mode}}$$

(3) Oxides of nitrogen:

$$\text{NO}_x \text{ pounds/1,000 pound-thrust hrs. or } \frac{}{1{,}000 \text{ hp.-hr., as appropriate/cycle}} = \frac{\text{Sum of the NO}_x\text{ mass/mode of ea. mode}}{\text{Sum of the work output of ea. mode}}$$

(b) The pollutant mass and work output per mode shall be computed by use of the following formulas:

(1) HC mass/mode = HC emission rate x TIM.
(2) CO mass/mode = CO emission rate x TIM.
(3) NO_x mass/mode = NO_x emission rate x TIM.
(4) Work output of each mode = power (in 1000 pounds thrust of 1000 horsepower) x TIM.

(c) The emission rates for each mode shall be computed by use of the following formulas:

$$\text{(1) HC emission rate} = \frac{M_{HC}\frac{(HC)}{10^6}F}{(M_C + {}_aM_H)\left(\frac{(CO)}{10^6} + (CO_2) + \frac{(HC)}{10^6}\right)}$$

$$\text{(2) CO emission rate} = \frac{M_{CO}\frac{(CO)}{10^6}F}{(M_C + {}_aM_H)\left(\frac{(CO)}{10^6} + (CO_2) + \frac{(HC)}{10^6}\right)}$$

$$\text{(3) NO}_x\text{ emission rate} = \frac{M_{NO_2}\frac{(NO_x)}{10^6}F}{(M_C + {}_aM_H)\left(\frac{(CO)}{10^6} + (CO_2) + \frac{(HC)}{10^6}\right)}$$

(d) The times in mode (TIM) shall be as specified below:

Time in mod (minutes)	Class T1 or P2	Class T2, T3 or T4
(1) Taxi/idle (out)	19	19
(2) Takeoff	0.5	0.7
(3) Climbout	2.5	2.2
(4) Approach	4.5	4.0
(5) Taxi/idle (in)	7.0	7.0

(e) Meaning of symbols:

(1) (i) HC mass/mode = Total mass of hydrocarbon emissions in pounds emitted during an operational mode as specified in Section 87.62 and paragraph (d) of this section.

(ii) CO mass/mode = Total mass carbon monoxide emissions in pounds emitted during an operational mode as specified in Section 87.62 and paragraph (d) of this paragraph.

(iii) NOx mass/mode = Total mass of oxides of nitrogen emissions in pounds emitted during an operational mode as specified in Section 87.62 and paragraph (d) of this section.

(2) (i) HC emission rate = Pounds/hour of exhaust hydrocarbons emitted in an operational mode.

(ii) CO emission rate = Pounds/hour of exhaust carbon monoxide emitted in an operational mode.

(iii) NOx emission rate = Pounds/hour of exhaust oxides of nitrogen emitted in an operational mode.

(3)
(i) M_{HC} = Molecular weight of methane, M_{HC} = 16.04.
(ii) M_{CO} = Molecular weight of carbon monoxide.
(iii) M_{NO_2} = Molecular weight of nitrogen dioxide.
(iv) M_C = Atomic weight of carbon.
(v) M_H = Atomic weight of hydrogen, M_H = 1.008.
(vi) a = Atomic hydrogen-carbon ratio of fuel.

(4) For each operating mode:

(i) (HC) = Concentration of hydrocarbons in the exhaust sample in parts per million carbon equivalent, i.e., equivalent propane x 3.
(ii) (CO) = Concentration of carbon monoxide in the exhaust sample in parts per million by volume.
(iii) (CO_2) = Concentration of CO in the exhaust sample in volume percent.
(iv) (NO_x) = Concentration of oxides of nitrogen in the exhaust sample in parts per million by volume, NO + NO_2.
(v) F = Mass rate of fuel flow in pounds per hour.

(5) TIM = Time in mode as specified in paragraph (d) of this section, divided by 60 to yield time in mode in hours.

§ 87.71 **Compliance with emission standards.**

Compliance with each emission standard by any aircraft or aircraft engine shall be determined by comparing the pollutant level in pounds/1,000 pound-thrust hours/cycle or pounds/1,000 hp.-hr./cycle as calculated in § 87.70(a) with the applicable emission standard under this part. The pollutant level for the cycle shall not exceed the standard.

Subpart H—Test Procedures for Engine Smoke Emission (Aircraft Gas Turbine Engines)

§ 87.80 **Introduction.**

Except as provided under § 87.5, the procedures described in this subpart shall be the test program to determine the conformity of new and in-use gas turbine engines with the applicable standards set forth in this part. The test is essentially the same as that described in §§ 87.60–87.62, except that the test is designed to determine the smoke emission level at various operating points representative of engine usage in aircraft. Other smoke measurement systems may be used if shown to yield equivalent results and if approved in advance by the Administrator.

§ 87.81 **Fuel specifications.**

Fuel having specifications as provided in Section 87.61 shall be used in smoke emission testing.

§ 87.82 **Sampling and analytical system for measuring smoke exhaust emissions.**

(a) *Schematic drawing.* Figure 5 is a schematic drawing of the exhaust smoke sampling and analytical system which shall be used in testing under the regulation in this subpart.

(b) *Component description.* The following components shall be used in the sampling and analytical system for testing under the regulations in this subpart.

(1) *Sample size measurement.* A wet or dry positive displacement meter shall be used to measure sample size to an accuracy of ±0.01 standard cubic foot. Pressure and temperature shall be measured immediately upstream of the meter. Accuracy shall be no less than ±0.10 in. Hg and ±4° F., respectively. If a dry type meter is used, it may be located between the filter holder and the vacuum pump.

(2) *Sample flow rate measurement.* Sample flow rate shall be measured with a rotameter with accuracy of no less than ±0.02 cubic foot per minute.

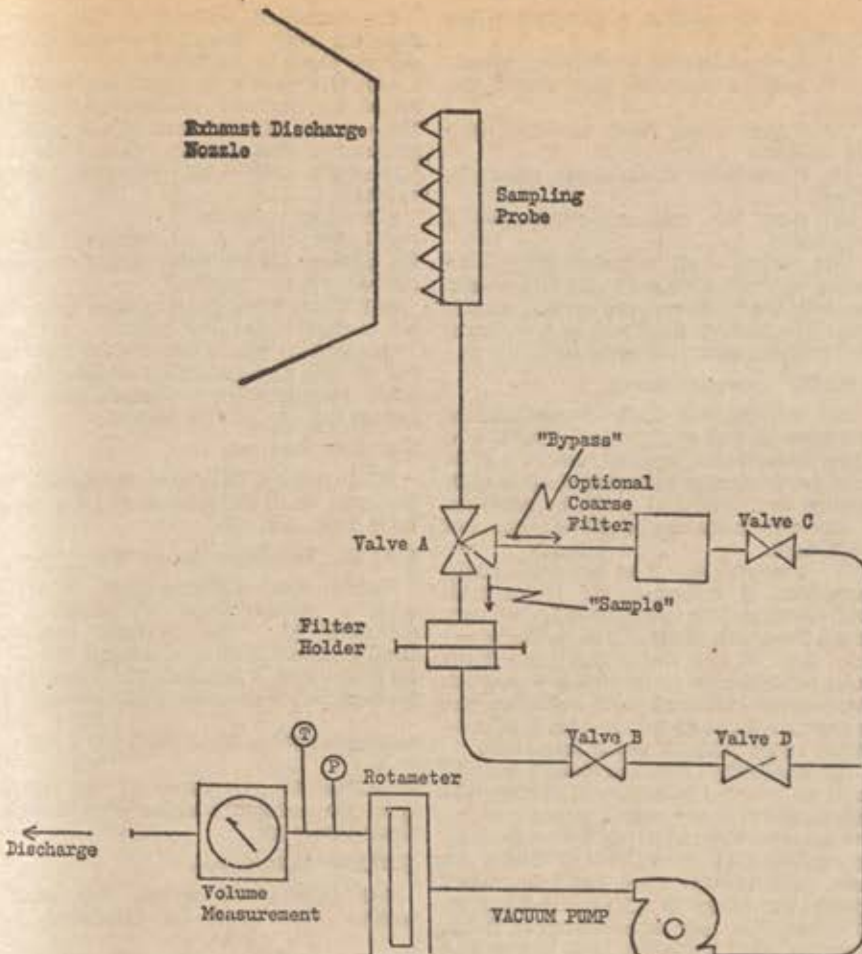
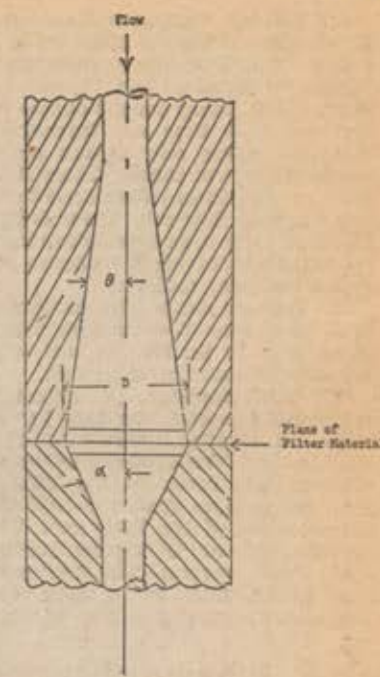


Figure 5 - SAMPLING SYSTEM SCHEMATIC DIAGRAM



D (Spot diameter) = 0.50 to 1.50 in.

θ = 5° to 7.5°

α = 20° to 30°

Figure 6 - FILTER HOLDER SCHEMATIC DIAGRAM

(3) *Filter holder*. The filter holder shall firmly clamp the filter material so that overall system leakage does not exceed that provided in § 87.84(c). The holder internal geometry shall be such that the variation of SN over the sample spot surface is not greater than two. Required elements of the filter holder design are given in Figure 6. The filter holder shall be made of corrosion resistant material.

(4) *Sampling probe*. The sample probe and procedure shall be the same as used to show compliance with § 87.64(c).

(5) *Sampling lines*. The sampling lines shall be straight through with no kinks or loops, and no bends having a radius of less than 10 line diameters. Sampling line inside diameter shall be within 0.18 to 0.32 inch. The sampling line section from the probe exit to valve A entrance shall be of minimum length, not greater than 75 feet, with a minimum of fittings or other breaks. Line material shall be such as to not encourage build-up of either particulate matter or static electric charge, such as stainless steel or copper.

(6) *Valving*. Four valve elements shall be provided. Valve A shall be a quick acting, full-flow, flow diverter with "closed," "sample," and "bypass" positions. Valve A may consist of two valves, provided that they are interlocked so that one of the pair cannot act independently of the other. Valves B and C shall be throttling valves used to establish a system flow rate. Valve D shall be a shutoff valve used in isolating the filter holder. All valves shall be made of corrosion resistant material.

(7) *Vacuum pump*. The vacuum pump shall have a no-flow vacuum capability of at least 22 in. Hg. V., and full-flow capacity of 1 s.c.f.m. minimum.

(8) *Reflectometer*. A reflectometer conforming to ASA standard for diffuse reflection density, number Ph2.17–1958, shall be used. The diameter of the reflectometer light beam on the filter paper shall be no more than one-half of "D," the diameter of the filter spot. The allowable range of "D" is given in Figure 6.

(9) *Filter material*. The filter material shall be Whatman No. 4 filter paper or equivalent approved by the Administrator.

§ 87.83 Information to be recorded.

The following information shall be recorded with respect to each test in addition to that information called for in § 87.65 (a) through (c).

(a) Sample temperature.

(b) Sample pressure.

(c) Actual sample volume at sampling conditions.

(d) Actual sample flow rate at sampling conditions.

(e) Leak and cleanliness checks substantiation as required by § 87.84 (b) and (c).

§ 87.84 Calibration and instrument checks.

(a) *Reflectometer calibration*. The reflectometer required by § 87.82(b)(8) shall be calibrated in accordance with manufacturer's specifications.

(b) *System maintenance*. The need for cleaning or replacement shall be determined by conducting the following cleanliness check:

(1) Full open valves B, C, and D.

(2) Use the vacuum pump and alternately set valve A to "bypass" and "sample" to purge the entire system with clean air for at least 5 minutes.

(3) Set valve A to "bypass."

(4) Close valve D and clamp clean filter material into the holder. Open valve D.

(5) Set valve A to "sample," reset back to "bypass" after 1 standard cubic foot of air per square inch of filter area has passed through the filter material.

If the filter spot exhibits SN greater than 3, the system lines must be cleaned or replaced. The system shall not be used until this cleanliness requirement has been met.

(c) *Leak check*. The following procedure shall be used to leak check the system.

(1) Clamp clean filter material into the holder.

(2) Close valve A, full open valves B, C, and D.

(3) Run the vacuum pump for 5 minutes.

The system shall be satisfactory if no more than 0.20 standard cubic foot passed through the volume meter during 5 minutes. The system shall not be used until this requirement has been met.

§ 87.85 Test procedures.

(a) The engine shall be operated as provided in § 87.62. The leak check and cleanliness check requirements of § 87.84 shall be confirmed before and after each engine test. The test shall be repeated if the requirements of § 87.84 are not confirmed.

(b) Precautions: The material being measured is composed of low-micron and/or submicron size agglomerated particles. Precautions should be taken to assure that steady state conditions have been achieved prior to taking a sample. To prevent material accumulation, the system shall not be left in a no-flow condition when exhaust gas is contained.

(c) Sampling: Not less than 1 minute shall be allowed to assure that the system is fully charged with a representative gas sample. The sampling flow rate shall be maintained at 0.50 ± 0.02 c.f.m. At least four sample sizes shall be taken within the range of 0.00765 to 0.115 lb. of exhaust gas per square inch of filter. Samples shall be taken both above and below 0.0230 lb. of exhaust gas per square inch of filter.

(d) Temperature control: The gas temperature from the sampling probe entrance to the filter material shall be above the dew point temperature. All lines and valves shall be lagged and/or heated as necessary to meet this requirement.

(e) Preparation for each power setting: The following shall be done to prepare the system at each power setting:

(1) Set valve A to "bypass," close valve D.

(2) Draw exhaust gas for 5 minutes minimum, then use valve C to set flow rate at 0.50 ± 0.02 c.f.m.

(3) Clamp clean filter material into the holder.

(4) Open valve D.

(5) Set valve A to "sample" and use valve B to again set the flow rate to 0.50 ± 0.02 c.f.m. This shall be done quickly before particulate buildup on the filter causes excessive pressure drop.

(6) Set valve A to "bypass" and close valve D.

(7) Clamp clean filter material into the holder.

(f) Sampling procedure: The procedure for smoke sampling at each power setting shall be as follows:

(1) With valve D closed and valve A set at the "bypass" position, charge the lines with exhaust gas for 1 minute minimum. Reestablish flow rate at 0.50 ± 0.02 c.f.m. as required, using valve C.

(2) Open valve D.

(3) Set valve A to "sample," allow the chosen sample volume to pass, then set valve A to "bypass."

(4) Close valve D and clamp clean filter material into the holder.

(5) Repeat subparagraphs (2) through (4) of this paragraph for at least three more sample sizes in accordance with paragraph (c) of this section.

§ 87.86 Test run.

With respect to engine operation, the test run shall be conducted in accordance with § 87.68.

§ 87.87 Determination of SN.

Smoke spot analysis shall be made with a reflectometer as specified in § 87.82(b)(8). The backing material shall be black with a maximum absolute reflectance of 3 percent. The reflectance reading of each spot shall be used to calculate SN by: $SN = 100\left(1 - \frac{Rs}{Rw}\right)$, where Rs=absolute reflectance of the sample spot. Rw=absolute reflectance of clean filter material.

§ 87.88 Calculations.

(a) *Calculation of W*. The sample weight (W) shall be calculated by: $W\ (\text{lb.}) = 1.326 \frac{PV}{T}$, where P and T are sample pressure and temperature in units of inches of mercury absolute and degrees Rankine, respectively, measured immediately upstream of the volume meter. V is measured sample volume in cubic feet.

(b) *Calculation of W/A*. The sample weight in pounds per square inch of filter spot area (W/A) shall be calculated for each sample size taken.

(c) *Plotting SN versus W/A*. All SN shall be plotted versus W/A on semilog coordinates, with W/A as the logarithmic abscissa. A straight line shall be fitted to these points using the method of least squares. Such a line shall be produced for each power setting specified.

(d) *Plotting reporting values of SN versus power setting*. Values of SN shall be read from the straight line functions of paragraph (c) of this section for W/A=0.0230 lb/sq. in. These SN are the values to be reported and shall be presented by plotting them as ordinate versus power setting as abscissa on rectangular coordinates.

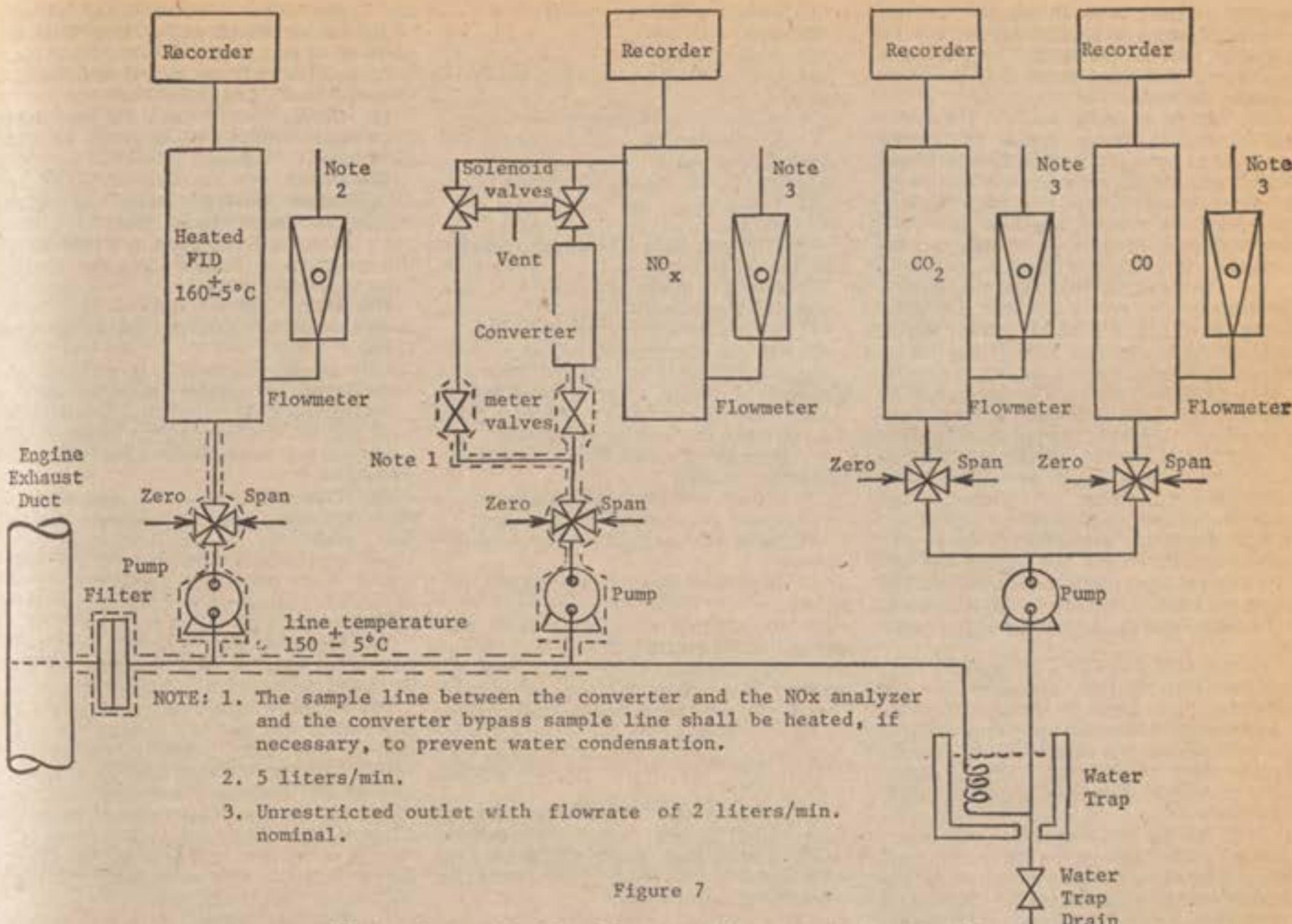


Figure 7

Piston Engine Sampling System and Instrument Arrangement

§ 87.89 Compliance with emission standards.

Compliance with each emission standard shall be determined by comparing the plot of SN versus power setting from § 87.88 with the applicable emission standard under this part. The SN at every power setting shall not exceed the standard.

Subpart I—Test Procedures for Engine Exhaust Gaseous Emissions (Aircraft Piston Engines)

§ 87.90 Introduction.

Except as provided under § 87.5, the procedures described in this subpart shall be the test program to determine the conformity of new and in-use aircraft piston engines with the applicable standards set forth in this part.

(a) The test consists of operating the engine at prescribed power settings on an engine dynamometer or test stand. The exhaust gases generated during engine operation are sampled continuously for specific component analysis through the analytical train.

(b) The exhaust emission test is designed to measure hydrocarbon, carbon monoxide, and oxides of nitrogen concentrations and determine mass emissions through calculations during a simulated aircraft landing-takeoff cycle (LTO). The LTO cycle is based on time in mode data during high activity periods at major airports. The test consists of five modes of engine operation: Taxi/idle (out), takeoff, climbout, approach, and taxi/idle (in). The mass emissions for the modes and engine rated power are combined to yield the reported values.

(c) When an engine is tested for exhaust emissions on an engine dynamometer or test stand, the complete engine shall be used with all accessories, which might reasonably be expected to influence emissions to the atmosphere, installed and functioning.

§ 87.91 Gasoline fuel specifications.

For exhaust emission testing, fuel meeting the specifications of ASTM D910 latest version for grades 80/87 or 100/130 (as applicable) shall be used. The lead content and octane rating of the fuel shall be in the range recommended by the engine manufacturer.

§ 87.92 Test procedure.

(a) (1) The engine shall be tested in each of the following five engine operating modes which simulate aircraft operation to determine its mass emission rates:

Mode	*Power setting (percent of rated power)*
Taxi/idle (out)	See subparagraph (2) of this paragraph
Takeoff	100 percent
Climbout	See subparagraph (3) of this paragraph
Approach	40 percent
Taxi/idle (in)	See subparagraph (2) of this paragraph

(2) The taxi/idle operating modes shall be conducted in accordance with the manufacturer's recommended power setting.

(3) The climbout operating mode shall be conducted in accordance with the manufacturer's recommended power setting: *Provided*, That the power setting shall be between 75 and 100 percent of rated power.

(b) Emission testing shall be conducted on warmed-up engines which have achieved a steady operating temperature.

§ 87.93 Sampling and analytical system for measuring exhaust emissions.

(a) *Schematic drawing.* Figure 7 is a schematic drawing of the exhaust gas sampling and analytical system which shall be used for testing under the regulations in this subpart. Additional components such as instruments, valves, solenoids, pumps, and switches may be used to provide additional information and coordinate the functions of the component systems.

(b) *Water removal devices*. No desiccants, dryers, water traps, or related equipment may be used to treat the exhaust sample flowing to the oxides of nitrogen measurement instrumentation. Temperature control shall be provided for NOx sample lines, hardware and instrument to prevent water condensation.

(c) *Component description (exhaust gas sampling system)*. The following components shall be used in the exhaust gas sampling system for testing under the regulations in this subpart:

(1) *Sampling probe*. The probe will be made of stainless steel of at least one-fourth inch outside diameter extending across the diameter of the engine exhaust duct. The gas sample will be drawn through a minimum of 5 holes in the sample probe distributed uniformly across the inside diameter of the engine exhaust duct. Where the engine has two or more exhaust pipes, the pipes shall be combined into a common exhaust pipe of sufficient length to provide for good mixing.

(2) *Sample transfer*. The sample shall be transferred from the probe to the analytical instruments through a stainless steel or Teflon sample line. Sample flow rate from the engine to the instruments shall be such that the transport time from exhaust pipe to instruments is 2 seconds or less.

(d) *Component description (exvhaust gas analytical system)*. The analytical system provides for the determination of hydrocarbon concentrations by flame ionization detector analysis, the determination of carbon monoxide and carbon dioxide concentrations by nondispersive infrared analysis and the determination of oxides of nitrogen concentrations by chemiluminescence analysis of exhaust samples. The chemiluminescence method of analysis requires that the nitrogen dioxide present in the sample be converted to nitric oxide before analysis. Other types of analyzers may be used if shown to yield equivalent results and if approved in advance by the Administrator. See appendix B of this part.

§ 87.94 Information to be recorded.

The following information, as applicable, shall be recorded with respect to each test:

(a) *General*. (1) Facility performing test.

(2) Description of test equipment including the probe and sampling and analytical train.

(3) Instrument operator.

(4) Test stand operator.

(5) Fuel identification including H/C ratio and additives, if any.

(b) *Aircraft (in which engine will be installed) description*. (1) Manufacturer.

(2) Model number.

(3) Serial number (if known).

(4) User.

(c) *Engine description*.—(1) Manufacturer.

(2) Model number.

(3) Serial number.

(4) Displacement.

(5) Type, manufacturer, and model of carburetion.

(6) Cylinder configuration.

(7) Turbocharger manufacturer and model, if applicable.

(d) *Test data*.—(1) Test number.

(2) Date.

(3) Time.

(4) Ambient temperature and engine inlet temperature.

(5) Barometric pressure.

(6) Relative humidity.

(7) Sample line temperature.

(8) Sample line residence time.

(9) All pertinent instrument information such as tuning, gain, full scale range.

(10) Recorder charts: Identify zero, span and exhaust gas sample traces.

(e) *Operating mode data*.—(1) Nominal power setting.

(2) Actual power setting, horsepower.

(3) Speed, revolutions per minute.

(4) Absolute manifold pressure, inches mercury.

(5) Measured fuel flow, pounds per minute.

(6) Air flow, pounds per minute and method of determination.

(7) Pollutant concentration, from recorders, in percent or parts per million by volume, and parts per million carbon for hydrocarbons.

§ 87.95 Calibration and instrument checks.

Calibration and instrument checks shall be performed in accordance with § 87.66 except that daily calibration and instrument checks shall be performed in accordance with § 87.96.

§ 87.96 Sampling procedures.

(a) *HC, CO, CO², and NOx measurements*. Allow a minimum of 2 hours warmup for the CO, CO_2, HC and NOx analyzers. (Power is normally left on infrared and chemiluminescence analyzers; but when not in use, the chopper motors of the infrared analyzers are turned off and the phototube high voltage supply of the chemiluminescence analyzer is placed in the standby position.) The following sequence of operations shall be performed in conjunction with each series of measurements:

(1) Check the sampling system for any leaks that could dilute the exhaust gas.

(2) Introduce the zero grade gas at the same flow rates used to analyze the test samples and zero the analyzers. Obtain a stable zero on each amplifier meter and recorder. Recheck after tests.

(3) Introduce span gases and set the CO and CO_2 analyzer gains, the HC analyzer sample capillary flow rate and electronic gain control, if provided, and the NO, anaylzer high voltage supply or amplifier gain to match the calibration curves. In order to avoid corrections, span and calibrate at the same flow rates used to analyze the test samples. Span gases should have concentrations equal to approximately 80 percent of each range used. If gain has shifted significantly on the CO or CO_2 analyzers, check tuning. If necessary, check calibration. Respan at least at end of test but not less than once per hour. Show actual concentrations on chart. Log gain readings.

(4) Check zeros; repeat the procedure in subparagraphs (1) and (2) of this paragraph if required.

(5) Check sample line temperature and sample residence time. To check sample residence time:

(i) Introduce HC span gas into sampling system at sample inlet and simultaneously start timer.

(ii) When HC instrument indication is 15 percent of span concentration, stop timer.

(iii) If elapsed time is more than 2.0 seconds, make necessary adjustments.

(iv) Repeat (i) through (iii) with CO, CO_2, and NO instruments and span gases.

(6) Check instrument flow rates and pressures.

(7) The engine shall be operated in each operating mode until emission levels have stabilized as indicated by a constant instrument reading or recorder ouput. This stabilized reading shall be recorded and used in calculating mass emission rates as called for in § 87.99.

(8) Measure HC, CO, CO_2, and NOx concentrations of the exhaust sample at the various modes called for in § 87.92.

(9) Recheck zero and span points at the end of the test and also at approximately one hour intervals during the test. If either has changed by ±2 percent of full scale, the test shall be rerun after instrument maintenance: *Provided*, That if it is impractical to repeat the test, a correction based on interpolation linear with time is acceptable for corrections within ±4 percent.

(b) *Carbon balance*. As a test of representative sample collection, a carbon balance shall be calculated from air and fuel flow data. This balance shall be within ±5 percent of that calculated from exhaust gas constituents or the test will be invalidated. Fuel flow data shall be derived by measurement during the test for which emissions are to be calculated. Air flow data preferably is from direct measurement but if such measurement is impractical, the data shall be taken from air consumption curves generated for the particular model of engine under test.

(c) *Sample system contamination*. (1) Care shall be taken to avoid loading of the sampling system with raw fuel discharge during engine starting.

(2) When the sample probe is in the exhaust stream and sampling is not in process, a back purge with air or an inert gas may be necessary to protect the probe and sample line from hydrocarbon buildup.

Check sample line for contamination each time the instrument zero and span points are checked. Use the following procedure to check the sample line:

(i) Immediately after instrument zero and span measurements and necessary adjustments are complete, introduce hydrocarbon zero gas near the sample probe. If the instrument zero reading increases by more than 5 percent of the scale in use the sample line shall be purged or cleaned as required, to bring the zero within limits.

(ii) When the requirements of paragraph (c) (2) (i) of this section have been met, introduce hydrocarbon span gas near the sample probe. If the instrument span reading is different by more than ±5 percent from the correct setting for the scale in use, the sample line shall be purged or cleaned, as required to bring the span within limits.

§ 87.97 Test run.

A test run shall consist of operating the engine in accordance with § 81.92. The engine shall be operated in the sequence called for under that section without intervening operating points unless an alternate procedure is agreed to in writing by the Administrator before such testing is conducted.

§ 87.98 Chart reading.

Determine the HC CO, CO_2, and NOx concentrations of the exhaust sample during the various modes from the instrument deflections or recordings making use of appropriate calibration charts. CO and CO_2 measurements shall be converted to a wet basis by multiplying the recorded concentrations by a conversion factor calculated in accordance with good engineering practices for rich or lean mixtures as appropriate from actual air and fuel flow measurements or from air consumption curves generated for the particular model of engine under test.

§ 87.99 Calculations.

(a) The final reported test results shall be computed by use of the following formulas:

(1) Hydrocarbon:

$$\text{HC pounds/rated power/cycle} = \frac{\text{Sum of the HC mass/mode of ea. of the modes}}{\text{Engine rated power (horsepower)}}$$

(2) Carbon monoxide:

$$\text{CO pounds/rated power/cycle} = \frac{\text{Sum of the CO mass/mode of each of the modes}}{\text{Engine rated power (horsepower)}}$$

(3) Oxides of nitrogen:

$$\text{NO}_x\text{ pounds/rated power/cycle} = \frac{\text{Sum of the NO}_x\text{ mass/mode of ea. of the modes}}{\text{Engine rated power (horsepower)}}$$

(b) The pollutant mass per mode shall be computed by use of the following formulas:

(1) HC mass/mode=HC emission rate x TIM.

(2) CO mass/mode=CO emission rate x TIM.

(3) NOx mass/mode=NOx emission rate x TIM.

(c) The emission rates shall be computed by use of the following formulas:

$$\text{(1) HC emission rate} = \dot{v}\text{ exhaust} \times \text{density HC} \times \frac{\text{HC conc}}{1{,}000{,}000}$$

$$\text{(2) CO emission rate} = \dot{v}\text{ exhaust} \times \text{density CO} \times \frac{\text{CO conc}}{1{,}000{,}000}$$

$$\text{(3) NO}_x\text{ emission rate} = \dot{v}\text{ exhaust} \times \text{density NO}_x \times \frac{\text{NO}_x\text{ conc}}{1{,}000{,}000}$$

(d) The time-in-mode (TIM) shall be as specified below (in minutes):

(1) Taxi/idle (out)	12.0
(2) Takeoff	0.3
(3) Climbout	5.0
(4) Approach	6.0
(5) Taxi/idle (in)	4.0

(e) Meaning of symbols:

(1) (i) HC mass/mode=Total mass of hydrocarbons emissions in pounds emitted during an operational mode as specified in § 87.92 and paragraph (d) of this section.

(ii) CO mass/mode=total mass of carbon monoxide emissions in pounds emitted during an operational mode as specified in § 87.92 and paragraph (d) of this section.

(iii) NOx mass/mode=total mass of oxides of nitrogen emissions in pounds emitted during an operational mode as specified in § 87.92 and paragraph (d) of this section.

(2) (i) HC emission rate=pounds/hour of exhaust hydrocarbons emitted in an operational mode.

(ii) CO emission rate=pounds/hour of exhaust hydrocarbons emitted in an operational mode.

(iii) NOx emission rate=pounds/hour of exhaust oxides of nitrogen emitted in an operational mode.

(3) V exhaust=Total engine exhaust volume flow rate in terms of cubic feet per hour at 68°F. and 760 mm. Hg pressure. V exhaust shall be calculated in accordance with good engineering practices from actual air and fuel flow measurements or from air consumption curves generated for the particular model of engine under test.

(4) (i) Density HC=Density of hydrocarbons in the exhaust gas, assuming an average carbon to hydrogen ratio of 1:1.85, in pounds per cubic foot at 68°F. and 760 mm. Hg pressure (0.0359 lb./cu. ft).

(ii) Density CO=Density of carbon monoxide in the exhaust gas in pounds per cubic foot at 68°F. and 760 mm. Hg pressure (0.0726 lb./cu. ft.).

(iii) Density NOx=Density of oxides of nitrogen in the exhaust gas, assuming they are in the form of nitrogen dioxide, in pounds per cubic foot at 68°F. and 760 mm. Hg pressure (0.119 lb./cu. ft.).

(5) (i) HC conc.=hydrocarbon concentration of the exhaust sample in pounds per minute carbon equivalent, i.e., equivalent propaneX3.

(ii) CO conc.=Carbon monoxide concentration of the exhaust sample in parts per million by volume.

(iii) NOx conc.=Oxides of nitrogen concentration of the exhaust sample in parts per million by volume.

(6) TIM=Time in mode as specified in paragraph (d) of this section divided by 60 to yield time in mode in hours.

§ 87.100 Compliance with emission standards.

Compliance with each emission standard shall be determined by comparing the pollutant level to pounds/rated power/cycle as calculated in accordance with § 87.99, with the applicable emission standard under this part. The pollutant level for the cycle shall not exceed the standard.

APPENDIX A—INSTRUMENTATION (AIRCRAFT GAS TURBINE ENGINE MEASUREMENTS)

(a) *NDIR instruments.* Nondispersive infrared (NDIR) analyzers shall be used for the continuous monitoring of carbon monoxide and carbon dioxide.

The NDIR instruments operate on the principle of differential energy absorption from parallel beams of infrared energy. The energy is transmitted to a differential detector through parallel cells, one containing a reference gas, and the other, sample gas. The detector, changed with the component to be measured, transduces the optical signal to an electrical signal. The electrical signal thus generated is amplified and continuously recorded. The NDIR analyzer used in accordance with Subpart H of this part shall meet the following specifications:

(*1*) *Response time (electrical).* 90 percent full scale response in 0.5 second or less. Zero drift—Less than ±1 percent of full scale in 2 hours on most sensitive range. Span drift—Less than ±1 percent of full scale in 2 hours on most sensitive range. Repeatability—±1 percent of full scale. Noise—Less than 1 percent of full scale on most sensitive range. Cell temperature—Minimum 50° C. maintained within ±2° C.

(*2*) *Range and accuracy.*

Range	*Accuracy excluding interferences*
Carbon monoxide:	
0 to 100 p.p.m.	±2 percent of full scale
0 to 500 p.p.m.	±1 percent of full scale
0 to 2500 p.p.m.	±1 percent of full scale
Carbon dioxide:	
0 to 2 percent	±1 percent of full scale
0 to 5 percent	±1 percent of full scale

(3) All NDIR instruments shall be equipped with cells of suitable length to measure exhaust concentrations within the ranges encountered to the indicated accuracy. Range changes shall be accomplished either by the use of stacked sample cells or changes in the electronic circuitry, or both.

(b) *Total hydrocarbon analyzer* (1) General design specifications. The measurement of total hydrocarbon is made by an analyzer using a flame ionization detector (FID). With this type detector an ionization current, proportional to the mass rate of hydrocarbon entering a hydrogen flame, is established between two electrodes; the small current is measured by an electrometer amplifier and continuously recorded.

The analyzer shall be fitted with a constant-temperature oven housing the detector and sample-handling components. It shall maintain temperature within ±2°C. of the set point, which shall be within 155° to 165°C.

The detector and sample handling components shall be suitable for continuous operation at temperatures to 200°C.

(2) The FID analyzer used in accordance with Subpart G of this part shall meet the following specifications:

Response time (electrical)—90 percent of full scale in 0.5 seconds or less.

Noise—±1 percent of full scale on most sensitive range.

Repeatability—±1 percent of full scale.

Zero drift—Less than ±1 percent of full scale in 2 hours on all ranges.

Span drift—Less than ±1 percent of full scale in 2 hours.

Linearity—Response with propane in air shall be linear with ±2 percent over the range of 0 to 2,000 p.p.m.C.

Accuracy:

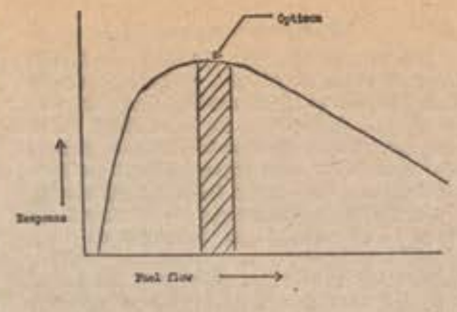
0 to 10 p.p.m.C.	±5 percent of full scale with propane calibration gas.
0 to 100 p.p.m.C.	±2 percent of full scale with propane calibration gas.
0 to 1,000 p.p.m.C	±1 percent of full scale with propane calibration gas.
0 to 2,000 p.p.m.C	±1 percent of full scale with propane calibration gas.

(3) Total hydrocarbon analyzer shall have an initial alignment as follows:

(i) *Optimization of detector response.* (*a*) Follow manufacturer's instructions for instrument startup and basic operating adjustment. Fuel shall be 60 percent helium, 40 percent hydrogen containing less than 2 p.p.m.C. hydrocarbon. Air shall be "hydrocarbon-free" grade containing less than 2 p.p.m.C.

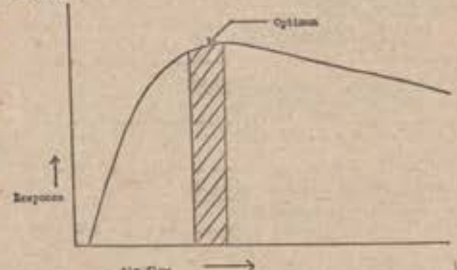
(*b*) Set oven temperature at 160°±5°C. and allow at least one-half hour after oven reaches temperature for the system to equilibrate. The temperature is to be maintained at set point ±2°C.

(*c*) Introduce a mixture of propane in air at a propane concentration of about 500 p.p.m.C. Vary the fuel flow to burner and determine the peak response. A change in zero may result from a change in fuel flow; therefore, the instrument zero should be checked at each fuel-flow rate. Select an operating flow rate that will give near maximum response and least variation in response with minor fuel-flow variations. A typical curve for response versus fuel flow is shown in the following figure.



RESPONSE VS. FUEL FLOW

(*d*) To determine the optimum air flow, use fuel flow setting determined above and vary air flow. A typical curve for response versus air flow is shown in the following figure:



RESPONSE VS. AIR FLOW

After the optimum flow settings have been determined these flows are to be measured and recorded for future reference.

(ii) *Oxygen effect.* Check the response of the detector with varied concentrations of oxygen in the sample following the steps outlined below; this test shall be made with oven temperature at the set point and with gas flow to the detector at optimum conditions, as determined in paragraph (b)(3)(i) of this section.

(*a*) Introduce nitrogen (N_2) zero gas and zero analyzer; check zero using hydrocarbon-free air; the zero should be the same.

(*b*) The following blends of propane shall be used to determine the effect of oxygen (O_2) in the sample.

Propane in N_2.

Propane in 10%±0.5% O_2 and balance N_2.

Propane in zero grade air (refer to 87.66 (c)).

The volume concentration of propane in the mixture reaching the detector should be about 500 p.p.m.C, and the concentration of both the O_2 and hydrocarbon should be known within ±1 percent of the absolute value. The zero shall be checked after each mixture is measured. If the zero has changed then the test shall be repeated.

The response to propane in air shall not differ by more than 3 percent from the response to propane in the 10 percent-O_2/90 percent-N_2 mixture, nor differ by more than 5 percent from the response to propane in nitrogen.

The difference between the response to propane in nitrogen and response to propane in diluent containing 10 percent O_2 shall not exceed 2 percent. If the 2 percent specification cannot be met by changing the sample flow rate or burner parameters, such as air and/or fuel-flow rate, the detector shall be modified or replaced.

(iii) Linearity and relative response.

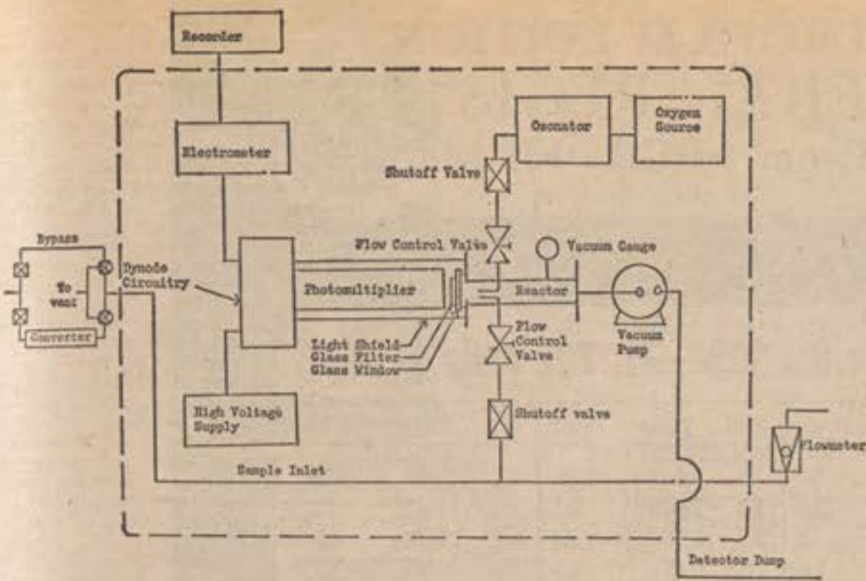
(*a*) With analyzer optimized in accordance with paragraph (b)(3)(i) of this section, the instrument linearity shall be checked for the ranges covering the range of analysis using propane in air at nominal concentrations of 30, 60, and 90 percent full scale of each range. The deviation of a best-fit curve from a least-squares best-fit straight line should not exceed 2 percent of the value at any point. If this specification is met, concentration values may be calculated by use of a single calibration factor. If the deviation exceeds 2 percent at any point, concentration values shall be read from a calibration curve prepared during this alignment procedure.

(*b*) A comparison of response to the different classes of compounds shall be made using (individually) propylene, toluene, n-hexane, and propane, each at 20 to 50 p.p.m.C concentration in air. If the response to propylene, toluene or n-hexane differs by more than 5 percent from the response to propane, check instrument operating parameters. Reducing sample flow rate improves uniformity of response.

(*c*) *Oxides of nitrogen analytical system.* The chemiluminescence method utilizes the principle that nitric oxide (NO) reacts with ozone (O_3) to give nitrogen dioxide (NO_2) and oxygen (O_2). Approximately 10 percent of the NO_2 is electronically excited. The transition of excited NO_2 to the ground state yields a light emission (600–2600 nanometer region) at low pressures. The detectable region of this emission depends on the PM-tube/optical filter being used in the detector. The intensity of this emission is proportional to the mass flow rate of NO into the reactor. The light emission can be measured utilizing a photomultiplier tube and associated electronics.

(1) The method also utilizes the principle that the thermal decomposition of NO_2 i.e., ($2NO_2 \rightarrow 2NO + O_2$), is complete at about 600°C. The rate constant for the dissociation of NO_2 at 600°C. is approximately 10^{6} (liters/mole-second). A 6-foot length of one-eighth inch outside diameter, 0.028 inch wall thickness, flawless stainless steel tubing resistance heated using a low voltage, high current power supply to a temperature of 650°C. provides sufficient residence time at a sample flow rate of 700 cc. per minute (1.5 c.f.h.) for essentially complete conversion of nitrogen dioxide to nitric oxide. Other converter designs may be used if shown to yield equivalent results.

(2) The method permits continuous monitoring of NOx concentrations over a wide range. Response time (2 to 4 sec. is typical) is primarily dependent on the mechanical pumping rate at the operating pressure of the reactor. The following figure is a flow schematic illustrating one configuration of the major components required for the oxides of nitrogen analytical system.



OXIDES OF NITROGEN ANALYTICAL SYSTEM

(3) The oxides of nitrogen analyzer used in accordance with Subpart G of this part shall meet the following specifications:

Response time (electrical)—90 percent of full scale in 0.5 seconds or less.

Noise—Less than 1 percent of full scale.

Repeatability—±1 percent of full scale.

Zero drift—Less than ±1 percent of full scale in 2 hours.

Span drift—Less than ±1 percent of full scale in 2 hours.

Linearity—Linear to within ±2 percent of full scale on all ranges.

Accuracy—±1 percent of full scale on all scales.

(d) The dynamometer test stand and other instruments for measurement of power output and the fuel flow measurement instrumentation in accordance with Subpart G of this part shall be accurate to within ±2 percent at all power settings.

APPENDIX B—INSTRUMENTATION (AIRCRAFT PISTON ENGINE MEASUREMENTS)

(a) The NDIR analyzers used for continuous monitoring of carbon monoxide and carbon dioxide in accordance with Subpart I of this part shall meet the following specifications:

(1) Response time (electrical—90 percent full scale response in 0.5 second or less. Zero drift—Less than ±1 percent full scale in 2 hours on most sensitive range. Span drift—Less than ±1 percent of full scale in 2 hours on most sensitive range. Noise—Less than 1 percent of full scale on most sensitive range.

(2) Range and accuracy:

Range	*Accuracy excluding interferences*
Carbon monoxide, 0–12 percent	±1 percent of full scale.
Carbon dioxide, 0–15 percent	±1 percent of full scale.

(b) The FID analyzer used for measurement of hydrocarbons in accordance with Subpart I of this part shall meet the following specifications:

Response time (electrical)—90 percent of full scale in 0.5 seconds or less.

Noise—±1 percent of full scale on most sensitive range.

Repeatability—±1 percent of full scale.

Zero drift—Less than ±1 percent of full scale in 2 hours on all ranges.

Span drift—Less than plus or minus of full scale in 2 hours.

Linearity—Response with propane in air shall be linear with ±2 percent over the range of 0 to 20,000 p.p.m.C.

Accuracy:

0 to 100 p.p.m.C.	±5 percent of full scale with propane calibration gas.
0 to 1,000 p.p.m.C.	±2 percent of full scale with propane calibration gas.
0 to 10,000 p.p.m.C.	±1 percent of full scale with propane calibration gas.

(c) The oxides of nitrogen analyzer used for measurement of oxides of nitrogen in accordance with Subpart I of this part shall meet the following specifications:

Response time (electrical)—90 percent of full scale in 0.5 second or less.

Noise—Less than 1 percent of full scale.

Repeatability—±1 percent of full scale.

Zero drift—Less than ±1 percent of full scale in 2 hours.

Span drift—Less than ±1 percent of full scale in 2 hours.

Linearity—Linear to within ±2 percent of full scale on all ranges.

Accuracy—±1 percent of full scale on all scales.

(d) The dynamometer, test stand, and other instruments for measurement of power output and air and fuel flow measurement instrumentation in accordance with Subpart I of this part shall be accurate to within ±2 percent at all power settings.

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